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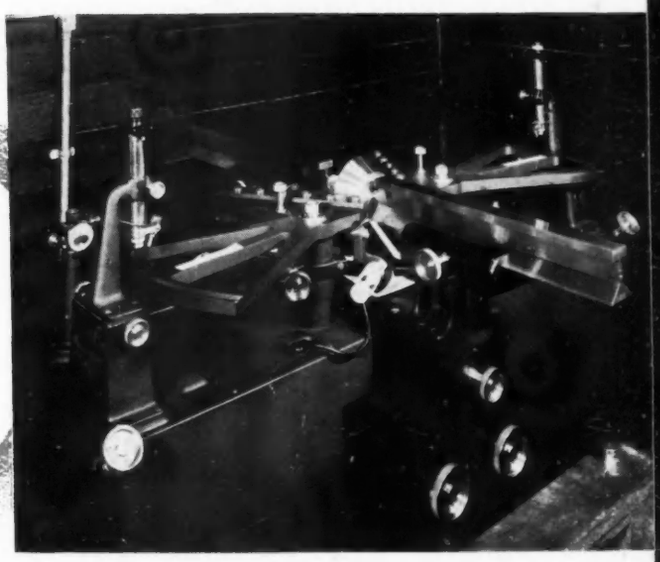
AUTOMOTIVE INDUSTRIES

LAND — AIR — WATER

AUGUST 15, 1941

The Most Accurate Angle Measuring Machine In The World!



The Timken Angle Measuring Machine with specimen in place.

The accuracy of this truly remarkable machine is certainly beyond the conception of most people and very probably even beyond the experience of many men who work with precision. Under ideal conditions it measures taper to within one second of arc which amounts to approximately 5/16 of an inch between the ends of two lines projected for one mile! That's really accuracy in any man's language.

It is used many times every day to check taper gauges which in turn check work gauges for the tapered parts of TIMKEN Tapered Roller Bearings. Although the degree of error of this machine seems unnecessarily small even for the manufacture of such a precise product as the TIMKEN Bearing, such is not the case. For instance, if the degree of error were 6 seconds and two gauges were required, one for a production line—the other for an inspection line, the possible degree of difference could be 12 seconds which is equal to 3/5 of .0001" for a specimen one inch long. We consider this too great.

The angle measuring machine is but one more reason why the performance of the TIMKEN Bearing has never been surpassed.

Detail of gauge holder and angle blades.

TIMKEN
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THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO

"Experts" Not Required

Shown is a Heald No. 48A Borematic, rough and finish borizing an electric tool housing.

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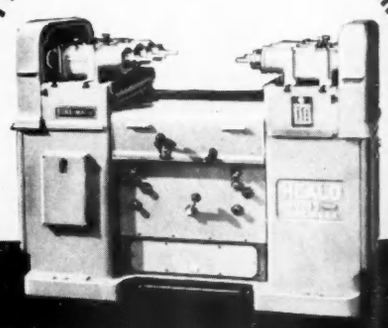
If you're loaded with defense production, but bogged down unfortunately by a crying need for highly skilled operators — here's a workable solution to your problem. Transfer some of your precision work to Heald Bore-Matics. Average operators can be trained in minimum time to operate these machines, producing work to the highest standards of accuracy and finish. Such results are possible and practical because Heald Bore-Matics' inbuilt craftsmanship plus single-point principle of finishing with cemented carbide or diamond tools gives "tenth" precision, shift in and shift out . . . because their operating ease and automatic features make "expert" operators unnecessary. As a means of putting precision in production 24 hours a day Heald Bore-Matics are worth looking into. Why not get in touch with us, *today*.

For Precision · Borize on Boremat



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The Automobile

Reg. U. S. Pat. Off.
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AUTOMOTIVE INDUSTRIES. Vol. 85, No. 4. Published semi-monthly by Chilton Co., Chestnut & 56th Sts., Phila. Entered as Second Class Matter October 1, 1925, at the Post Office at Philadelphia, Pa.; Under the Act of Congress of March 3, 1879. In Case of Non-Delivery Return Postage Guaranteed. Subscription price: United States, Mexico, United States Possessions, and all Latin-American countries, $1.00 per year. Canadian and Foreign $2.00 per year; single copies, 25 cents, except Statistical Issue (Mar. 1, 1942), 50 cents.

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IN THIS ISSUE . . .

AUTOMOTIVE INDUSTRIES

Reg. U. S. Pat. Off.

Volume 85 August 15, 1941 Number 4

Canada to Cut Output 44%

Passenger car production in Canada for 1942 will be cut to approximately 44 per cent of 1940 production, according to recent announcement of Minister of Munitions Howe. This would limit 1942 passenger car output to approximately 48,450 units compared to 110,126 passenger cars in 1940. A total of 65,199 passenger cars were produced in the first six months of 1941. Quotas have been set up for 1941 production, limiting it to the 1940 total and the foreign currency content of cars to not more than 20 per cent. The number of passenger car models will be reduced from 147 to 79 in 1942.

Repair Rationing Plan

Assuring a steady flow of maintenance and repair parts to essential industries, OPM has announced a new Maintenance and Repairs Rating Plan which is available at once to more than 150,000 producers, manufacturers and agencies in nine industrial classifications. Additional industrial classifications will be added to the list as rapidly as facilities permit. Those granted the use of the plan will get an A-10 rating which they can apply to their orders for necessary repair and maintenance parts.

A MESSAGE

TO YOU . . .

Defense Savings Bonds and Stamps give us all a way to take a direct part in building the defenses of our country—an American way to find the billions needed for National Defense.

The United States is today, as it has always been, the best investment in the world. This is an opportunity for each citizen to buy a share in America.

Quality Control of Wright Engine Parts **14**

Eleven hundred highly trained inspectors maintain the high degree of accuracy that is so necessary in aircraft engine production. How the work is carried through with a minimum of rejects is told in this article by the chief inspector himself.

Bomber Parts by DeSoto and Plymouth **18**

Many parts of the Martin B-26 are being made by these two automobile plants. An enlightening presentation of the methods and equipment used are shown in pictures starting on page 18.

Control Systems for Modern Planes **20**

The airplane of today is a maze of controls as compared with an automobile. There are several systems in common use and in this article the authors have discussed a number of them so that the reader can not alone inform himself, but make his own comparisons for any particular type of plane.

Mass Production of Airplanes **26**

The plant engineering department of the Vultee Aircraft through one of its members has supplied this account of the operating details of the new defense production line at the plant in Downey, Calif. New ideas are coming forth with each turn of the clock and the Vultee plant has a goodly number of them which this article tells about.

Packard's Rolls-Royce Plant **30**

Intricate and interesting machines are keyed up to a high pitch of production at this plant in turning out the 1300-hp. Merlin engines for the United States and British air forces. The telling of it depends in great part on a series of very informative pictures.

Tubing in Automobile Construction **38**

The use of tubing in the last few years has gone in for great many new developments and many changes. How this new type of construction is produced and used is told here in a description of the Dewey process which is a licensed system developed through the Republic Steel Corp.

TRADE **AUTOMATIC** MARK

MANUFACTURERS FOR OVER 30 YEARS

Electric Propelled INDUSTRIAL TRUCKS

Fig. 10537-39. Heavy-duty Telescopic Fork Trucks stacking 10,000-lb. bundles steel plate after transporting from receiving. Lower view shows same truck servicing one of many Die-presses with steel plates. Note how truck places load at convenient height to operator.

Fig. 10544. Outside storage of engine blocks on pallets in unit loads with "AUTOMATIC" Fork Trucks provides an economical handling system with highest efficiency for Inventory and Production Control.

Fig. 10562. Operator withdrawing Special Skid Racks loaded with Crankshafts from Heat Treat Ovens. These are transported to storage and box-cars for shipment to assembly plants. Fork Truck illustrated is available in 3,000- to 7,000-lb. capacities.

Fig. 10541. One of the many efficient production jobs performed by "AUTOMATIC" 10,000-lb. High Lift Trucks. Truck illustrated facilitates general transportation and placing of Bundled Steel Plate at Presses.

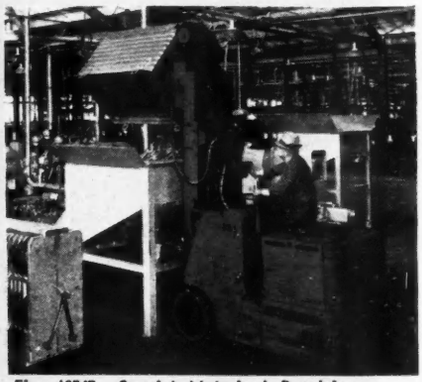

Fig. 10547. Special Motorized Revolving Fork Attachment built integral with Telescopic Fork Truck Lift provides efficient system for charging hoppers as shown with miscellaneous small parts as required for Water and Oil Pump Assemblies — also Valve Guides, Connecting Rods, etc.

MODERN PRODUCTION TOOLS CONTRIBUTING IMPORTANT ECONOMIES TO MODERN BUSINESS

• The "Electric Propelled" Fork Trucks, Die Handlers and Lift Trucks illustrated here are typical of the complete range of "AUTOMATICS" Time Proven Production Tools. These are offered to the Automotive and Aircraft and Metal Industry to facilitate improved handling methods and modern low-cost co-ordinated handling systems regardless of load 2,000 or 30,000 lbs.

Hundreds of these "AUTOMATICS" shown here are today operating in many modern plants in United States, Canada and Foreign Countries. They are vital factors twenty-four hours, day in, day out, contributing successful, dependable, economical, profitable materials handling, transportation and stacking. Each of these "AUTOMATICS" reflect the ultimate in Modern Design — Sturdy Construction — Greater Capacity Facilities — Increased Efficiency—Dependable Performance—Flexibility with Precision and Safety.

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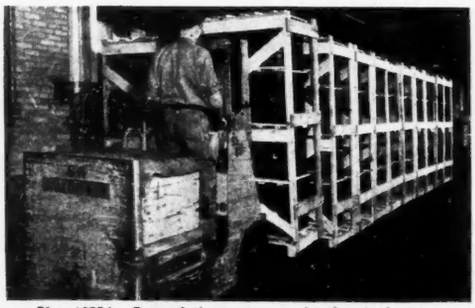


Fig. 10554. One of the many production tasks performed by "AUTOMATIC" Fork Trucks is unloading unit loads of radiators from box-cars and transporting to storage and assembly.

Fig. 10559. Unit load of steel plate blanks formed for rear axles being placed in production storage by "AUTOMATIC" Center-Control Fork Trucks. Capacities 3,000 to 7,000 lbs.

Fig. 10536. Heavy-duty "AUTOMATIC" Die-handler, 20,000 lbs. capacity. Fully equipped with latest motorized Die Loading and Unloading Platform to facilitate accurate Die Placing and efficient transportation to and from storage.

WHEN YOU BUY TRUCKS · · *Buy* "AUTOMATIC"

AUTOMOTIVE INDUSTRIES

Published on the 1st and 15th of the month

Vol. 85, No. 4
August 15, 1941

Teamwork Expedites Bomber Program at Automobile Plants

By E. L. WARNER, JR.

AUTOMOBILE and aircraft companies, embracing some of the best engineering talent in the United States, have teamed up to provide the nation with bombing planes to insure the national defense. Work is nearing the production stage on the plan conceived last October by William S. Knudsen, director of OPM, and then carried out by the Automotive Committee for Air Defense, under which four of the automobile manufacturers will turn out bomber airframe parts to be assembled at Government-financed plants in the Midwest. In addition, other automobile body and parts manufacturers are making airframe parts and subassemblies for a number of aviation companies. All this is supplemental to the big role of the automobile industry in manufacturing aircraft engines.

An essential difference between the two industries, now so closely linked, is that automobile companies produce yearly models, while aircraft companies must constantly make improvements in competition with the enemy. Warplane designs can be standardized for only a limited period. It is a case of survival of the best in aerial warfare.

When the bomber airframe program was advanced to the automobile companies, there were five major factors involved—floor space, equipment, labor, management and experience. Floor space was the easiest to obtain. The companies either had some available or could build new factories in a short time. Management and experience in airframe fabrication were the most difficult to locate.

The present emergency has drained the available supply of management and engineers versed in aircraft production. Management has had to be spread thin over the various projects while new men are being trained in aircraft processes and automobile-trained engineers are readjusting their experience to aircraft manufacturing techniques. The aircraft companies have furnished trained engineers and executives to guide the automobile men in different manufacturing routines. In turn, the automobile engineers have taken advantage of their mass production experience to suggest short cuts and better methods for certain operations. Uncle Sam has been the beneficiary of this pooling of experience. As a result, the automobile plants will begin producing bomber airframe parts within four months, while full production will be achieved by next June.

Co-ordination and inspection of this huge bomber program, which will see automobile plants producing 500 bomber airframes per month by next summer, are centered in the U. S. Army Air Corps. Each aircraft plant requires an Air Corps personnel equal to about one per cent of the plant's total employment. Thus the Ford Willow Run bomber plant near Ypsilanti, Mich., which contemplates peak employment of 60,000 workers, would require 600 Air Corps officers and employes. Coordination of this bomber program is directed from the Air Corps Central Procurement District office at Detroit.

Ford Motor Co., which will build the B-24D four-engine bomber for the Army, has had 250 engineers, designers and draftsmen at the Consolidated Aircraft Corp. plant in San Diego, Cal., many of them going there last March, to study the 14,000 blueprints that are required for the airframe of the 24-ton plane. Ford engineers have divided the B-24D airframe into 70 principal segments for manufacture. Assembly jigs have been installed in a building at the Ford Airport in Dearborn and 10 airframes will be "hand assembled" there before the new plant at Willow Run opens next spring. Several hundred draftsmen also are engaged in plant layout problems in the airport building.

Fisher Body Division of General Motors, which will produce airframe sub-assemblies for the B-25C medium bomber at the rate of 100 per month, has had 110 key men at the North American Aviation, Inc., plant in Inglewood, Cal., learning aircraft techniques. These men will fill vital positions in the Fisher Memphis Aircraft Division at Memphis, Tenn.

Fisher will produce the entire B-25C airframe, comprising nine major subassemblies, with the exception of the center wing section and the landing gear, for shipment to the North American plant at Kansas City, Kan., for final assembly. This constitutes 75 per cent of the airframe. Although still awaiting the arrival of tools and equipment, the Memphis plant soon expects to attain a production rate of one set of subassemblies per day, with full production of five a day to be achieved by spring. Four Fisher plants at Detroit will supply die castings and deep drawn pressings.

(*Turn to page 52, please*)

These young women are inspecting some of the 105,000 parts which pass through their hands daily. More than 32,760,000 parts receive their first testing here each year in vendor's inspection.

Quality of Wright

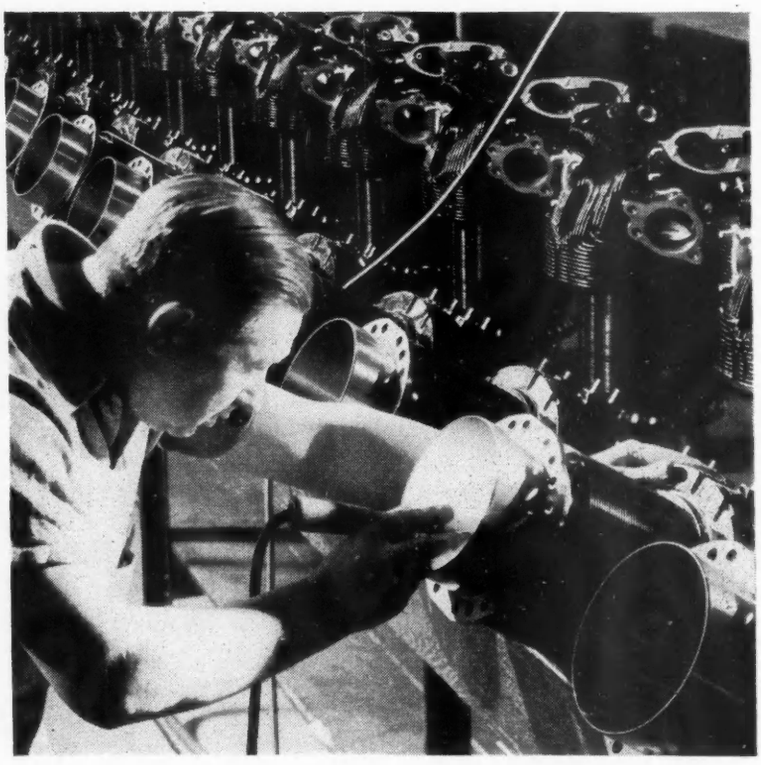
By SAMUEL RAY*

THE EFFICIENCY with which an aircraft engine performs depends mainly on the standards of quality maintained at the source of manufacture. It is on the shoulders of those in the inspection department where rests this responsibility.

At the Wright Aeronautical Corporation the utmost care is exercised in maintaining quality from the time rough forgings or castings are first introduced into the plant, until they have eventually reached the stage of machined perfection. The inspection organization, at its Paterson, N. J., plants (the new Cincinnati plant will have a similar inspection set-up) consists of 1100 highly efficient inspectors. The department is controlled by a Quality Manager, who reports directly to the General Manager. Reporting directly to the Quality Manager are two Chief Inspectors, one directly in charge of all inspection activities performed in the Manufacturing Department, and the other having the responsibility of inspection functions in the Assembly, Service and Test Departments.

In addition to the Chief Inspectors, the Quality Manager has directly under his supervision an assistant thoroughly familiar with all phases of inspection and assembly practice. It is the duty of this assistant to follow and take

The Cylinder Inspection Dept. uses a special light to reveal any scratches in completed cylinders.



* Chief Inspector, Manufacturing Division, Wright Aeronautical Corp. Based on paper read at A.S.M.E. Management Conference on National Defense, Philadelphia.

Wright trainees are receiving instruction at a radial drill as it drills and reams valve holes in a Cyclone cylinder head. These machines have been set up by the company to train thousands of men for skilled jobs in the National Defense program.

corrective action on any difficulties which might arise from production or assembly inspection. Each Chief Inspector has under his supervision several supervisors and foremen, to whom report leadmen. Leadmen are comprised of inspectors thoroughly familiar with all the details and requirements of inspection, and have charge of smaller groups of inspectors.

Foundry

As a part of our foundry inspection, we have a Pattern Layout Department, where the first casting from each pattern is thoroughly checked for dimensions, after which it is sectioned and the wall thick-

Control

Engine Parts

nesses checked. In the event any variations occur, the pattern is immediately corrected and a second casting checked to insure parts being strictly within blue print limits prior to being released for production. Also, to insure forgings received from vendors being entirely within blue print limits, the vendor submits a lead or mineral cast from each new die. These sample casts are thoroughly checked by our Pattern Layout Department to blue print dimensions, after which the finish lines are scribed on the part to insure its being within finished blue print dimensions, prior to receipt of forgings. As in the case of castings, a second sample is requested for layout purposes in the event the first sample is found to be unsatisfactory. After lead or mineral cast has been approved by our Pattern Layout Department, it is submitted to

To detect any flaws, all crankshafts receive magnetic inspection. Wright was the first to apply this method in production and it is now used on all highly stressed parts.

the Project Engineer and Production Engineering Department for final approval. Upon final approval, the vendor is immediately notified by telegram, whereupon the dies are hardened and forgings supplied on a production basis.

Tool Inspection

Too much importance cannot be stressed on the role played by our tool inspectors, some of whom have been with us since the aircraft industry was in its infancy. Each new tool, gage and fixture is inspected to the most minute detail before being released to the Production or Inspection Departments, since the quality of our product depends to a great extent on the accuracy of the fixtures and tools with which the component parts are made. Our tool inspectors are furnished with the finest obtainable equipment, including a Leitz projector or comparator, Zeiss optical devices and electrical measuring equipment.

In addition to the main tool inspection crib, in which all new checking devices are inspected, throughout the shop are located various tool inspection cribs, where machinists and inspectors may bring their micrometers and other personal tools to be checked. All company measuring equipment, such as snap gages, plug gages, thread gages, etc., as well as personal tools, must be checked periodically, at which time the latest date of inspection is stamped on a metal tag sealed to the gage. Each crib is equipped with a set of Johannsen blocks and master gages with which to perform this inspection.

Machine Shop

Men, classified as floor inspectors, are stationed in all Production Departments throughout the machine shop. It is the duty of such floor inspectors to carefully inspect the first piece from each set-up on the various machines. Should any discrepancies be noted, necessary adjustments are immediately made and the condition remedied, thus preventing a repetition of the error on subsequent parts. We have found the assignment of floor inspectors a worthy asset in preventing parts not conforming to blue print requirements from reaching final inspection in increased quantities.

To more accurately control the inspection of heat treated parts, several inspectors are stationed in the Heat Treat Department, where, with the use of Rockwell or direct reading Brinell hardness testing machines, parts are carefully checked for proper hardness after heat treatment. Also, prior to the release of case hardened parts, samples are sectioned and the depth of case measured to insure the proper case depth has been obtained.

Also on the inspection staff are approximately 60 girls efficiently trained in the inspection of smaller parts, such as studs, nuts and valve guides. A large percentage of our hardness testing is performed by these girls on Rockwell and Scleroscope machines.

Due to increased production brought about by the National Defense program, arrangements have been made with the local vocational school in Paterson to train young men mechanically inclined for inspection

(Left) Finished master connecting rods are weighed carefully by an inspector to make sure that each end has exactly the specified weight.

(Below) A mould maker is removing the finished sand mould for a cylinder head casting at Wright's new aluminum foundry, Fair Lawn, N. J.

In vendor's inspection, the suppleness and deftness of feminine fingers are utilized for testing push rod ball ends and valves for Wright Cyclone and Whirwind engines.

duties. These young men, after satisfactory completion of their vocational studies, are hired as junior inspectors, working on small miscellaneous parts, and are carefully tutored and trained in the importance and necessity of perfect workmanship on parts used in aircraft engines.

Raw Materials Inspection Department

All rough forgings, castings, bar stock, etc., are first delivered to the Raw Materials Inspection Department, where they are given a preliminary inspection to forging blue print requirements. Prior to delivery of any forgings to the shop, samples are taken from each heat of steel, and forwarded to the Laboratory, where chemists perform both chemical and physical analyses. All materials remain in raw materials inspection until such time as a final approval is given by the Laboratory for use of same. This check of analyses is made in addition to the certified analyses reports submitted by the vendors supplying steel. All lots of steel are given a code number for identification purposes, so if necessity demands, parts or stock may be traced through the plant during course of manufacture. Prior to acceptance of any forgings, a sample is first carefully inspected for grain flow by the staff in our Laboratory.

Finished Parts

During the past few years the quality of steel used in the manufacture of aircraft parts has been decidedly improved by the adoption of Magnaflux inspection, or magnetic detection of flaws or forging defects in steel. Practically all steel parts produced at the Wright plants are inspected by this method, and in many cases serious flaws are detected, which, under ordinary visual observance, would pass by unnoticed. Such parts are removed immediately from production.

The general run of normal hairline seams or inclusions are no longer a source of worry to the operator, as the parts are carefully inspected by the Inspection Department before final acceptance. However, we have standardized the practice of rechecking all parts at overhaul periods to assure ourselves that such inclusions have not progressed. We have found through years of experience, however, that this type of indication does not progress.

There are two types of cracks which might occur on service parts; namely, the well known fatigue crack, which immediately discards the part from further use, and cracks which appear on hardened surfaces, due to abnormal heating by friction. Such parts can often be reworked by grinding or stoning and, providing the surface hardness has not been impaired, can be applied for further use.

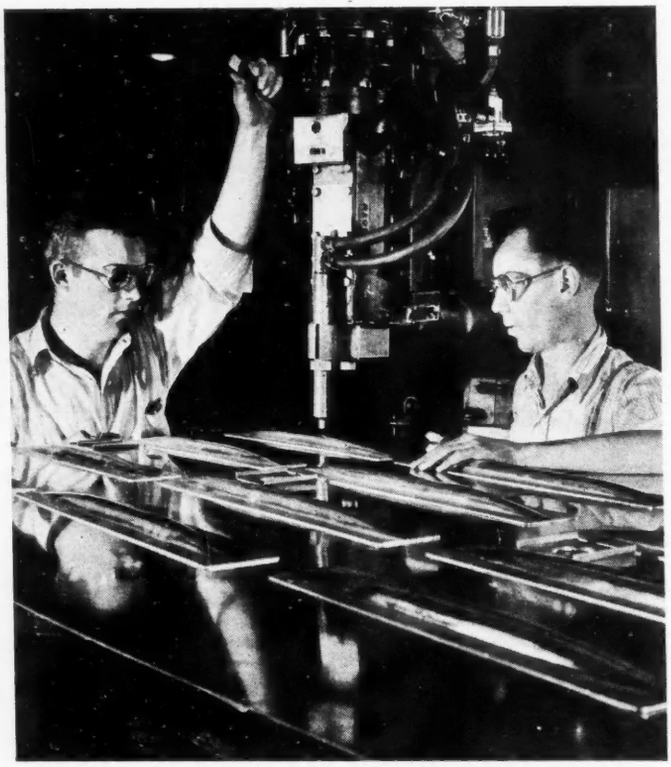
On highly stressed parts, such as master and articulating rods, crankshafts and propeller shafts, accurate records are kept on cards which bear a sketch of the part, and on which notations are made to designate exactly where any inclusions appear. These cards con-

(*Turn to page* 60, *please*)

AVIATION INDUSTRIES

Bomber Parts

by De Soto and Plymouth

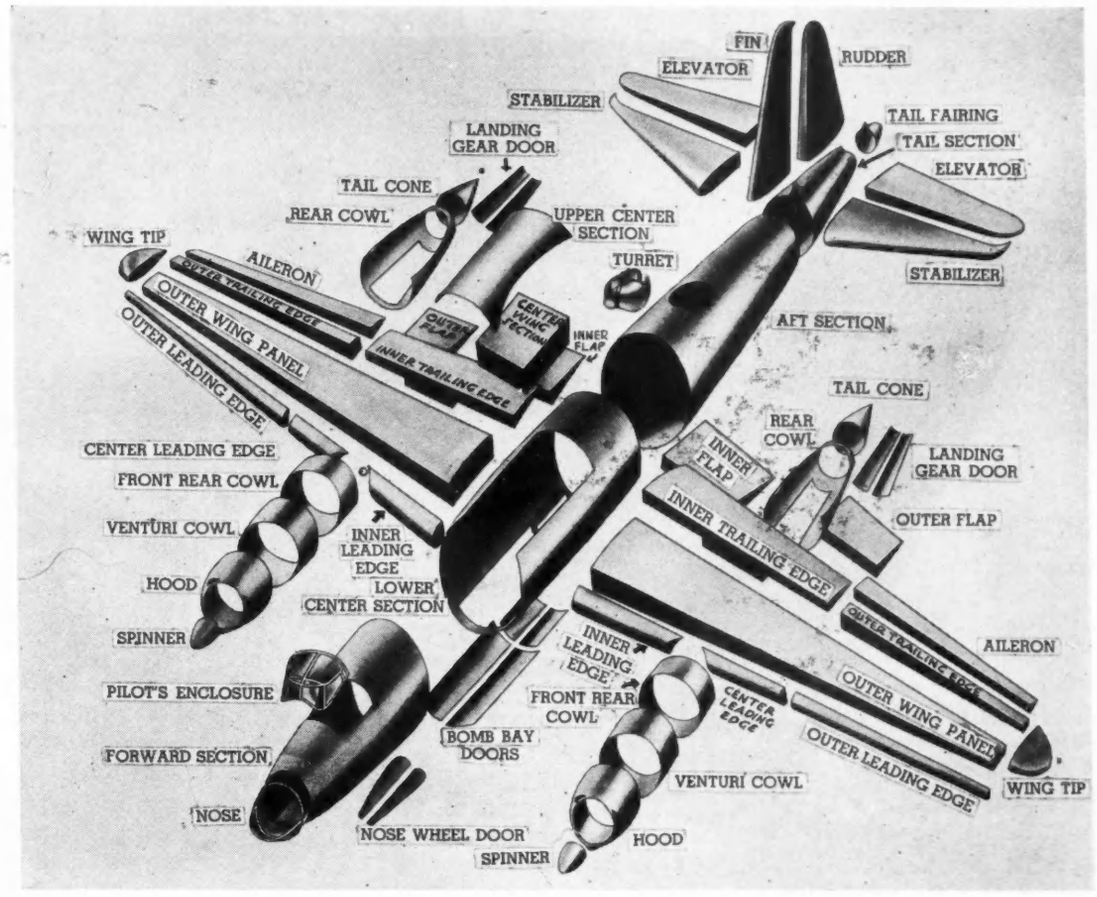


Successful use of spot welding in joining aluminum alloy parts has been limited because of the high heat conductivity of the aluminum, its low melting point and its sensitivity to local overheating, which made good spot welding very difficult. Recent advances in the art have made aluminum spot welding practical for many parts. Here is an example of this work at the Glenn Martin plant.

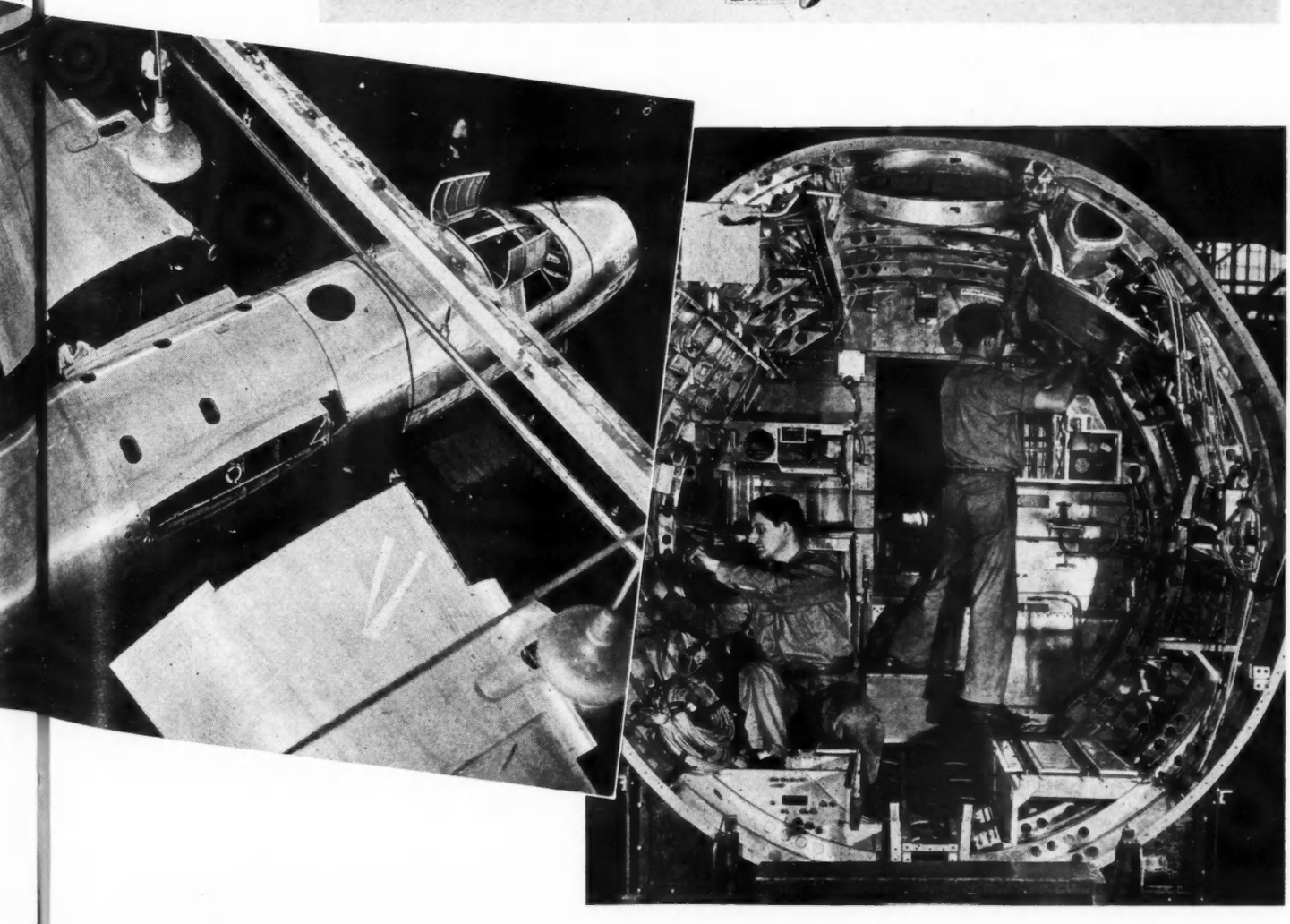
Final assembly of the Martin B-26 at the stage where the wings are being assembled to the fuselage, followed later by the installation of two 1850 hp. engines.

Plymouth and De Soto are "tooling up" to build more than 1700 structural parts for the Martin B-26 bomber, which can do better than 340 m.p.h. and can carry 2½ tons of bombs to a target 700 miles away. Chrysler Corp.'s $42-million contract calls for delivery of complete nose and fuselage center sections to Martin's new factory at Omaha, Neb.

Construction of large bombers is almost a shipbuilding job as this section clearly shows. This section of the fuselage, which comes directly under the gun turret, will be produced ready for assembly into the Martin B-26 by Plymouth and De Soto, and is typical of the work being performed for the airplane companies by the automobile industry. It is interesting to note the maze of wires, control cables, piping and air duct in the modern military airplane.



Many major assemblies and subassemblies go to make up the modern bomber. The Martin B-26 has 32 major assemblies, each of which is divided into 650 sub-assemblies.



AVIATION INDUSTRIES

Control Systems for A

By Henry L. Brownback
and P. M. Heldt

THE MODERN airplane, and particularly the military plane, is a maze of controls. It has controls not only for the spark and throttle, the same as the motorcar, but also for the variable-pitch propeller—controlling the pitch either directly or through a pitch-control governor—for the carburetor mixture, carburetor heat, carburetor de-icer (in some cases), oil radiator, cowl flap, landing-gear retractor, brake, gasoline shut-off and switching valves, gasoline-tank dump valve, and the rudder, ailerons and elevator, which latter are provided in duplicate. Then there are the adjustable stabilizer control, the trimmer-flap control and landing-flap controls. Other controls are necessary for radio, ventilating systems, oxygen-supply and fire-fighting systems, and navigation equipment; on military planes there are, in addition, machine-gun and cannon controls, turret controls, gun-synchronizer controls, bomb-release and bomb-door controls. In multi-engined planes, moreover, all of the engine controls must be provided in multiple, one set for each engine. All planes designed for operation at high altitudes must carry de-icing equipment on wings, propellers, and auxiliary control surfaces, all of which call for additional controls.

While there is a tendency to make some of these controls automatic, duplicate manual controls must be provided, so that the failure of some delicate device cannot endanger the entire plane. Where automatic pilots are used, the crew must take the plane off and land it, and whenever rapid maneuvers are required, they must also control it, hence the installation of an automatic system does not reduce the complication of the control installation; it does, however, relieve the pilot of the task of constantly attending to the controls and permits him to devote practically his whole attention to flying.

One of the conditions that must be considered when designing aircraft controls is the sudden and wide changes in atmospheric temperatures encountered. For instance, a machine may take off in Texas or California with sub-tropical temperatures prevailing, and within a few minutes reach an altitude where the air is at Arctic temperature, and in an equally short time it may be back in the heat again. These sudden temperature changes produce stresses in the structure which must be provided against. What is still worse, a large amount of condensed moisture may get into the control system, and upon reaching the upper strata of the atmosphere, may freeze, thereby jamming some important mechanism. Oils suitable for lubrication at sea level may congeal at high altitudes, "freezing" or locking important parts, and the greatest care must be exercised that only the special oils recommended for this purpose are used, or that the parts are left unlubricated or practically so.

Another difficulty arises from the fact that many of the adjustments made through control mechanisms are very delicate. For instance, an average governor-controlled constant-speed propeller will change the engine speed about 15 r.p.m. for each degree of movement of the control lever. To obviate trouble from this

Modern Planes

cause, the control system must be devoid of backlash or play, the parts must be supported at short intervals, so that vibration cannot attain any great amplitude, the whole system must work freely to make accurate adjustment possible, and in many cases micrometer controls must be provided to permit of the delicate adjustment required to synchronize several engines.

While control levers differ widely in details of design, they all involve a common principle in that the major movement is effected by means of a lever which is provided with a lock, and means for a secondary micrometer adjustment. The lever thus can be set to give the desired adjustment approximately, and then locked, the final close adjustment being made by means of the micrometer.

Aircraft controls are of three general types, viz., mechanical, hydraulic, and electric. In the present article only the hydraulic type will be discussed. Hydraulic controls again may be divided into two classes —low-pressure and high pressure. The former may be considered to include all systems in which the hydraulic pressure never exceeds 1000 lb. per sq. in., while in the latter the pressure ranges between 1000 and 4000 lb. per sq. in. and even higher. American practice has favored the low-pressure, French and German practice the high-pressure system. One reason why preference has been given to the high-pressure system abroad is that it has been found possible to store a sufficient volume of oil under these high pressures to operate controls with the engine at rest, and also to use this high-pressure oil to start even the most powerful engines—both Diesel and gasoline—more quickly than was possible with cartridge starters. It is further claimed that with high operating pressures there is little or no danger of the system becoming jammed, by reason of the freezing of condensed water, a difficulty which has been experienced with the low-pressure system.

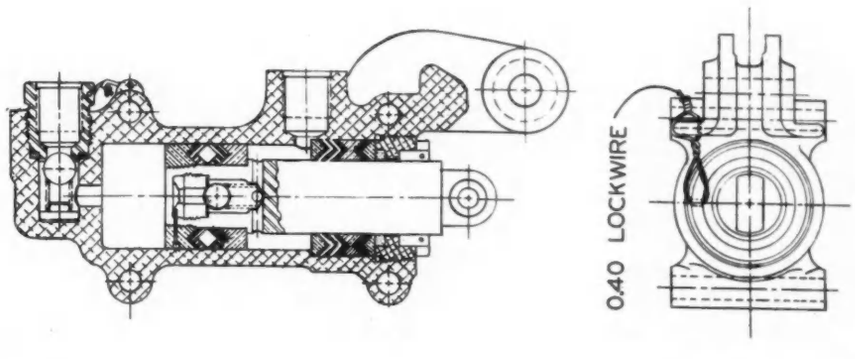
In some of the low-pressure systems, a pedal- or lever-operated piston in a cylinder will force oil to one or more cylinders at a distance, to perform the work to be done, in substantially the same manner as in the familiar case of automobile hydraulic brakes. In other systems a power-driven pump returns the oil delivered, through a by-pass to the intake side, until pressure is needed to operate some device. Then the by-pass is closed and pressure is rapidly built up in the line.

Air Associates Control Systems

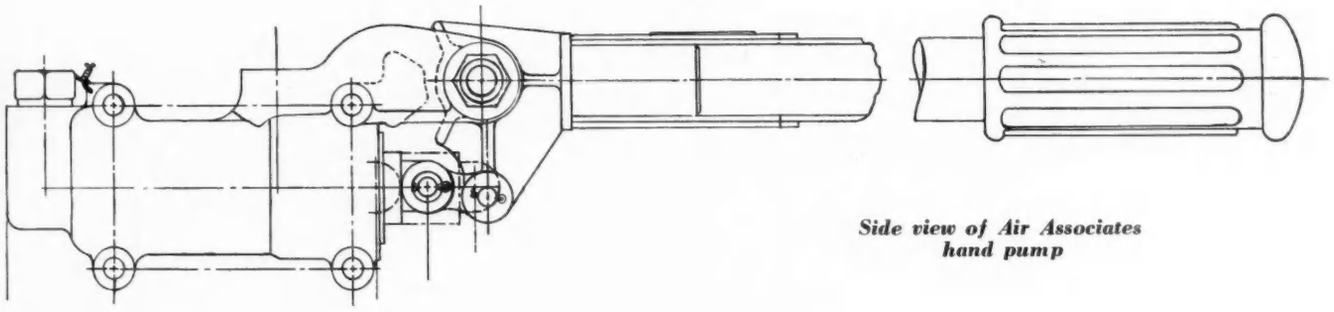
AIR ASSOCIATES, INC., Bendix, N. J., manufacture and distribute various parts of aircraft hydraulic control systems, including hand pressure pumps and control cylinders or jacks. Sectional and assembly drawings of one of the hand pumps are shown herewith. Hand pumps are required to put the hydraulic fluid under pressure under emergency conditions on airplanes equipped with engine-operated pumps, or as the sole source of hydraulic pressure on airplanes not so equipped. To make the pump light, aluminum is used wherever possible, and all working parts are held to very close tolerances. The pump body is an aluminum casting which is machined to remove all unnecessary weight. The pump handle is made of aluminum tubing and the only steel parts are the piston and the link assembly. Check valves are claimed to be so accurately fitted that the leakage under a pressure of 1000 lb. per sq. in. will not exceed two drops per minute. All seals are made of Neoprene.

Model HC-561 landing-gear-retraction cylinder, as used with these pumps, consists of a steel cylinder containing a piston and having ports at opposite ends for connection to a source of hydraulic supply, so that the piston may be driven hydraulically in either direction. A sleeve designed to connect the piston to the landing gear is provided with pressure-gun fittings for lubricating the mounting bolts.

The tubular piston rod is made of hardened steel, prime-painted on the inside, and hard-chromium-plated on the outside after grinding, the chromed surface then being polished. The piston itself is of neo-



Sectional and end view of Air Associates hand pump



Side view of Air Associates hand pump

prene, which is bonded to the piston spacer. Standard ⅛-in. pipe connections are used to connect the hydraulic pipe lines to the cylinder.

Air Associates also make a wing-flap retracting cylinder, as another part of the system. A piston, made of neoprene bonded to the piston spacer, moves within the cylinder and has the piston rod connected to it by a flexible joint. The piston rod is adjustable for length. The piston works against a heavy loading spring that holds it normally in the retracted position. Hydraulic pressure acting against the opposite side drives the piston down in the cylinder, compressing the spring. When the pressure is removed, the loading spring returns the piston to the retracted position. The piston stroke is 2 23/32 in., with an hydraulic pressure of 500 lb. per sq. in. At the beginning of the stroke the spring loading is equal to 50 lb. per sq. in.; at the end of the stroke, 235 lb. per sq. in. The weight of the entire cylinder assembly is 5¾ lb.

Dowty Lifeline Control System

DOWTY EQUIPMENT CORPORATION of New York produces hydraulic control systems for aircraft of various types. The system consists essentially of four elements, viz., an hydraulic pump, a reservoir, control valves, and operating jacks. The engine-driven pump is of the radial-piston type and incorporates its own pressure regulator and relief valve. In normal flight, with no services operating, the pump maintains full pressure in the line but absorbs only little power. When a control valve is opened, pump delivery begins, and it continues until the particular service is completed. From the accompanying circuit it will be seen that there are three connections at the pump; two of these are the usual suction and delivery connections, while the third is a so-called "centrifuge" connection, this latter carrying an auxiliary flow induced by the pump rotor which has the effect of keeping the pump cool under all operating conditions. According to the manufacturers, this pump will operate at pressures up to 3000 lb. per sq. in. and weighs 9.5 lb.

The control valve is of balanced design, so that it can be moved without great effort even at high pressures. There is a check valve in the inlet port. The weight of the valve is 1.7 lb. A hand pump is generally required with this system, for emergency use and for tests. The hand pump supplied by the manufacturers has a check valve in the delivery line. The pump delivers 0.6 cu. in. per delivery stroke against a back pressure of 2000 lb. per sq. in., with a hand pressure of 40 lb. applied to the end of a 16-in. lever. Its weight is 2.5 lb.

Airaco Hand Pumps

HAND PUMPS for hydraulic control systems are being manufactured also by the Aircraft Accessories Corporation of Glendale, Calif. Shown herewith is a section of the No. 65008 double-acting pump which delivers 2 cu. in. per operating cycle. It consists of an aluminum housing provided with a steel liner and having chambers in which four ball check valves are located, two suction and two delivery. A piston assembly containing two sets of packing is secured to the piston rod, which latter passes through a packing gland at that end of the pump body where the actuating handle is located. The handle is held in a fulcrum socket that pivots on a steel bushing held by a bolt passing through lugs extending from the housing, and is connected to the piston rod by links. To ensure long life of the packings, the piston rod is plated with hard chromium and the cylinder liner is ground to a mirror finish. All wearing surfaces are on bronze and steel. These pumps are tested under a pressure of 1500 lb. per sq. in.

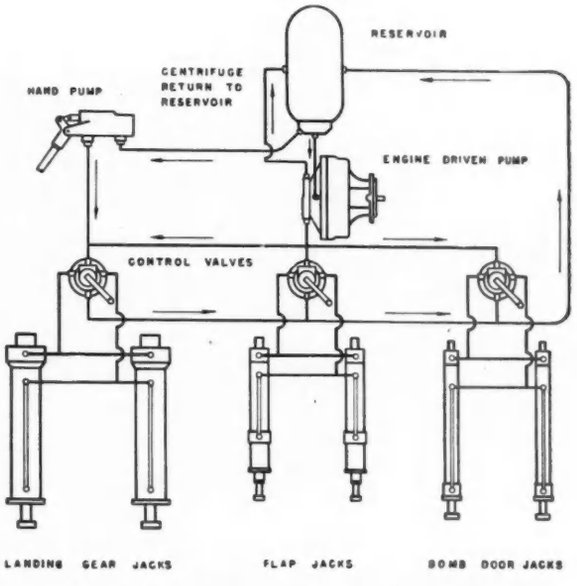
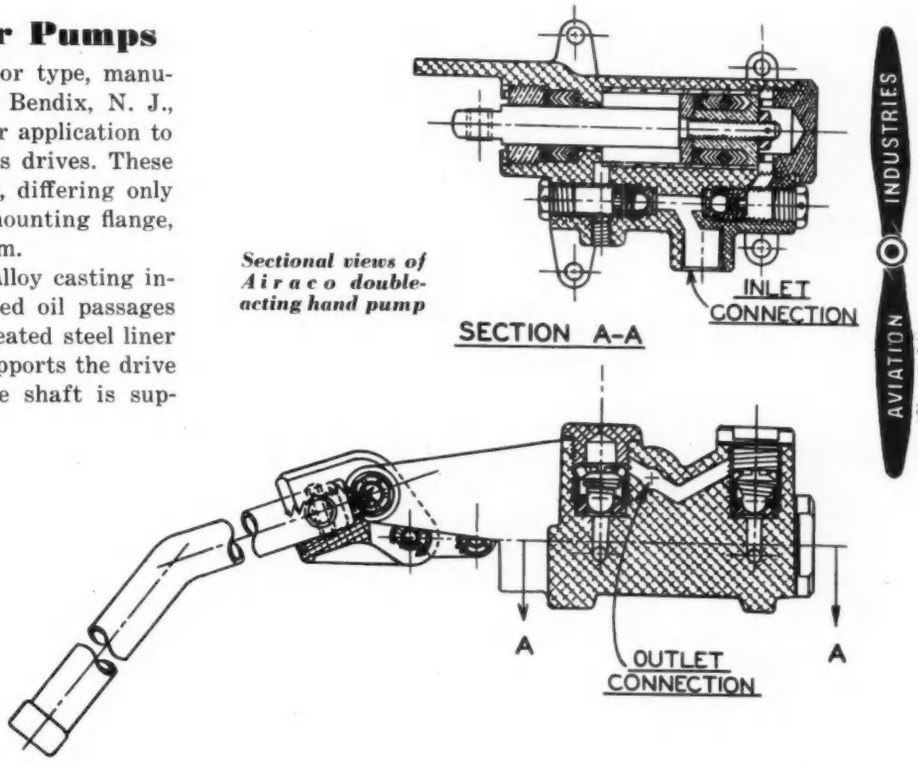


Diagram of Dowty control system

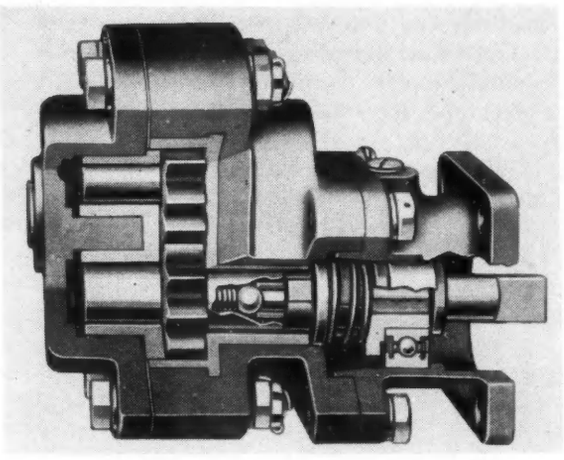
Engine-Driven Gerotor Pumps

ENGINE-DRIVEN pumps of the Gerotor type, manufactured by Eclipse Aviation of Bendix, N. J., are available in three capacities and for application to the various standard engine accessories drives. These pumps are of the same general design, differing only with respect to the drive member or mounting flange, and the width of the Gerotor mechanism.

The pump housing is an aluminum-alloy casting incorporating the mounting flange, drilled oil passages to relieve back pressure, and a heat-treated steel liner for the double-row ball bearing that supports the drive shaft. The outboard end of the drive shaft is supported in a needle bearing. The Gerotor mechanism, located in the pump housing consists of an inner rotor keyed to the drive shaft, and an outer rotor that revolves in a stationary eccentric ring between two plates doweled to the pump housing. These parts are held in position by the pump head of cast aluminum, which contains pipe-threaded suction and delivery ports, as well as studs to ensure proper alignment and free turning of moving parts. There is an oil seal at the coupling end of the drive shaft. The drive coupling is held in position on the shaft by means of spring-backed detents which fit in recesses on the end of the shaft. This makes possible quick removal of the coupling for inspection. In addition, the drive coupling is designed to act as a "weak link" and shear when a given torque is exceeded, thus protecting the driving member and the internal pump parts from damage. It is recommended that a separately mounted pressure-relief valve be installed in the delivery line and set for a maximum pressure of 1000 lb. per sq. in., in order to prevent overloading of the pump.



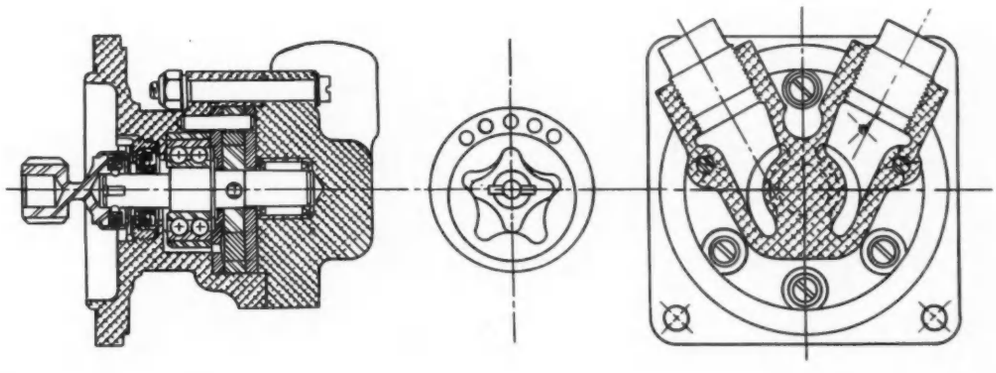
Sectional views of Airaco double-acting hand pump



Cut-away view of Pesco standard gear-type pump

Pesco Pumps

PUMP ENGINEERING SERVICE CORPORATION of Cleveland manufactures two types of pump for hydraulic controls, vane-type and gear-type. The vane-type is a four-vane positive-displacement pump designed to operate at pressures up to 200 lb. per sq. in. It has a housing of aluminum alloy within which there is a liner that is bored out eccentric to the shaft. Within this bore operates a rotor with four sliding vanes, supported in bronze bearings. At low speeds a center pin floating inside the hollow rotor keeps the outer edges of the vanes in contact with the interior surface of the liner. At normal operating speeds the vanes are pressed into contact with the liner by centrifugal force.



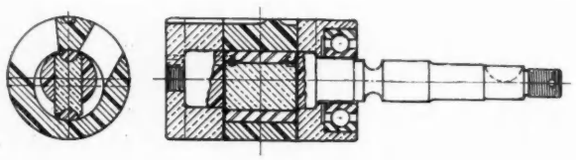
Sectional views of Gerotor pump

The gear pump operates on the same principle as pumps used in automobile engine lubrication systems. Two closely meshed steel gears are located in a cast aluminum housing provided with a bronze liner. There are two removable bronze bushings in the cover. The pump is mounted on the engine by means of an adapter containing a ball bearing. A coupling supported by the ball bearing transmits driving torque from the engine through a universal block to the driving gear of the pump. Pumps have been installed also without the bearing and universal block, the coupling then engaging the gear shaft directly.

The pump is provided with a metallic seal. While most of the pumps are designed for operation in one direction only, the gear-type pumps can be rendered reversible by a special combination of check valves. A check valve in the drive-gear shaft keeps the seal primed with oil and prevents the entrance of air if sudden starting should cock the universal block. These pumps can be provided with relief valves located in a by-pass between the suction and delivery ports, which open when the pressure in the system exceeds that for which the valve is set. Adjustments are made by means of a nut on the outside of the pump. The gear-type pumps are suitable for operation at pressures of 1000 lb. per sq. in. and more and at speeds of 1000 to 4500 r.p.m.

Romec Pump

THE ROMEC RB-2870 hydraulic pump, made by the Romec Pump Co. of Elyria, Ohio, is designed for the hydraulic operation of landing gear and wing flaps. As shown by the accompanying sectional views, it consists of a pump housing, an offset rotor, and a solid vane. It has a capacity of 2.4 g.p.m. at 2400 r.p.m. and 700 lb. per sq. in. discharge pressure, and 0.25 g.p.m. at 400 r.p.m. and 700 lb. per sq. in. discharge pressure. The pump is designed to be driven from the engine through the gun-synchronizer drive and a right-angled bevel-gear drive adapter, at crankshaft speed.



Romec hydraulic pump

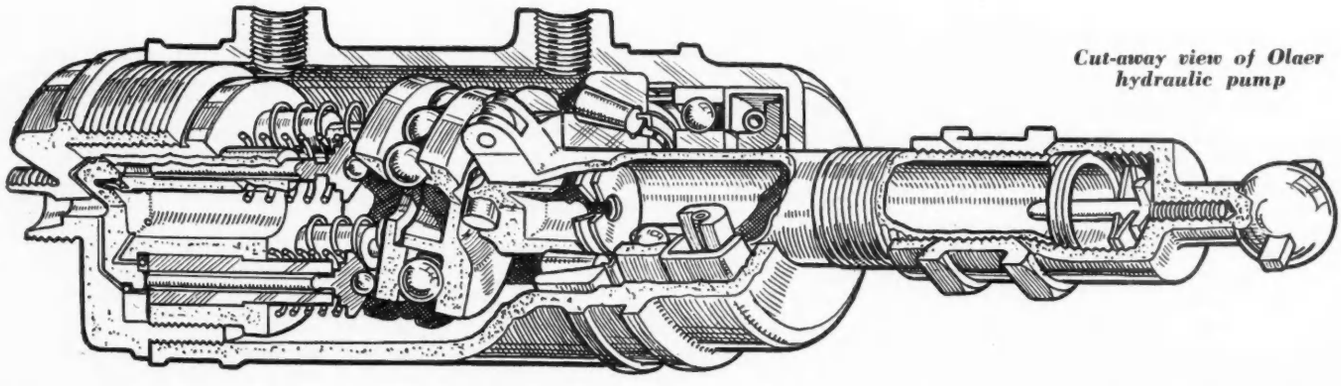
Suction and delivery ports are at right angles with each other, and are tapped with ¾-in. and ⅜-in. pipe threads, hence the pump can be driven in one direction only and is not reversible. The object in using a larger suction port is to prevent cavitation.

Rotor and drive shaft are integral and have the 16-tooth driven bevel gear keyed to the shaft and held firmly against the inner race of the outer ball bearing. Thrust of the bevel gear is taken up on the annular ball bearings. The shaft is provided with a 'shear section which will shear in the event of an excessive load.

Leakage of fluid along the drive shaft is prevented by a spring-loaded "Cook-type" seal running against a bronze seat. Any fluid leaking by the seal collects in the annular groove in the seal seat. from which there are drain channels to an annular groove on the outside of the seat, which connects with a drain channel drilled in the pump housing. The hydraulic fluid generally used with the Romec system is a half-and-half mixture of diacetone alcohol and castor oil.

Olaer Control System

IN FRANCE a hydraulic control system has been developed by the Société Anonyme de Matériel Oléo Pneumatique, well known for its Oléo shock absorbers for landing gears. A diagram of the system is shown herewith. Fluid is forced by an engine-driven pump into a storage reservoir under high pressure (of the order of 4000 lb. per sq. in.). The pump is of the barrel type, comprising six cylinders containing plungers that are actuated by a wobble-plate mechanism. As shown in the cut-away view of the pump, a circular disk within the pump housing is hinged near its edge to a lug on the driving shaft, and a spring made up of numerous washers lodged in a bore in the shaft, presses through a plunger and roller against the plate at its center, forcing it to assume a position inclined to the shaft. The plate hinged to the driving shaft evidently must rotate with it, and, therefore, is a swashplate. This plate supports another through a circle of balls, and this latter plate, which does not rotate but merely wobbles, imparts linear motion to the pump plungers. It takes ¼ hp. to drive the pump at 2000 r.p.m. The pump weighs about 2 lb. and has a delivery of approximately 1 qt. per min. at 2000 r.p.m. It is claimed to be able to operate without injury at speeds up to 3200 r.p.m.



Cut-away view of Olaer hydraulic pump

As the pressure in the system rises, the back pressure of the liquid on the wobble plate reduces the angularity of the latter, and therewith the delivery of the pump, until the predetermined pressure is reached, when the wobble plate reaches a position at right angles to the axis of the driving shaft. The stroke of the pump plungers is then reduced to zero, and thereafter the pump consumes very little power.

After leaving the pump, the liquid enters the pressure reservoir, in which it is balanced against the air pressure. Formerly the liquid and the compressed air in the reservoir were separated by a sliding piston, but experiment showed that a synthetic-rubber bag served the purpose just as well. This was substituted for the sliding piston, and a light-alloy cylinder took the place of the alloy-steel cylinder, which permitted of a weight saving of about 6.5 lb. The pressure inside the bag balances that against its outside, hence the bag is subjected to low stress only.

Fluid under pressure is carried through metal pipes to cylinders which operate various devices on the plane, passing through control valves on the way. The connections of the piping system are of a type which has been proven to be capable of working under a pressure exceeding 10,500 lb. per sq. in. without leakage. The operating cylinders may be either single-acting (with spring return), double-acting, or of the two piston type, in which case equal pressures are exerted simultaneously in opposite directions.

The operating cylinders are made as light as possible, considering the loads imposed upon them. For instance, on a 5500-lb. pursuit plane the landing-gear retractor cylinder complete weighs 2.15 lb.; the cylinder operating the radiator shutters, 1.25 lb., and the antenna control, 14 oz. In a bomber the bomb-release cylinder control weighs 1 lb. 12 oz.

The liquid is drawn from a tank at atmospheric pressure and forced by the pump into the reservoir, where it is balanced against air pressure. The reservoir is said to have sufficient capacity to start the largest engine either on the ground or in the air, to raise or drop the landing gear (which is accomplished in from 2 to 3 min.), and to completely raise or lower the landing flaps twice (with the engine pump in operation). As a safety measure, the reservoir may be fitted with a connection to a small CO_2 bottle, which can be used to "boost" a "dead" reservoir in case of emergency.

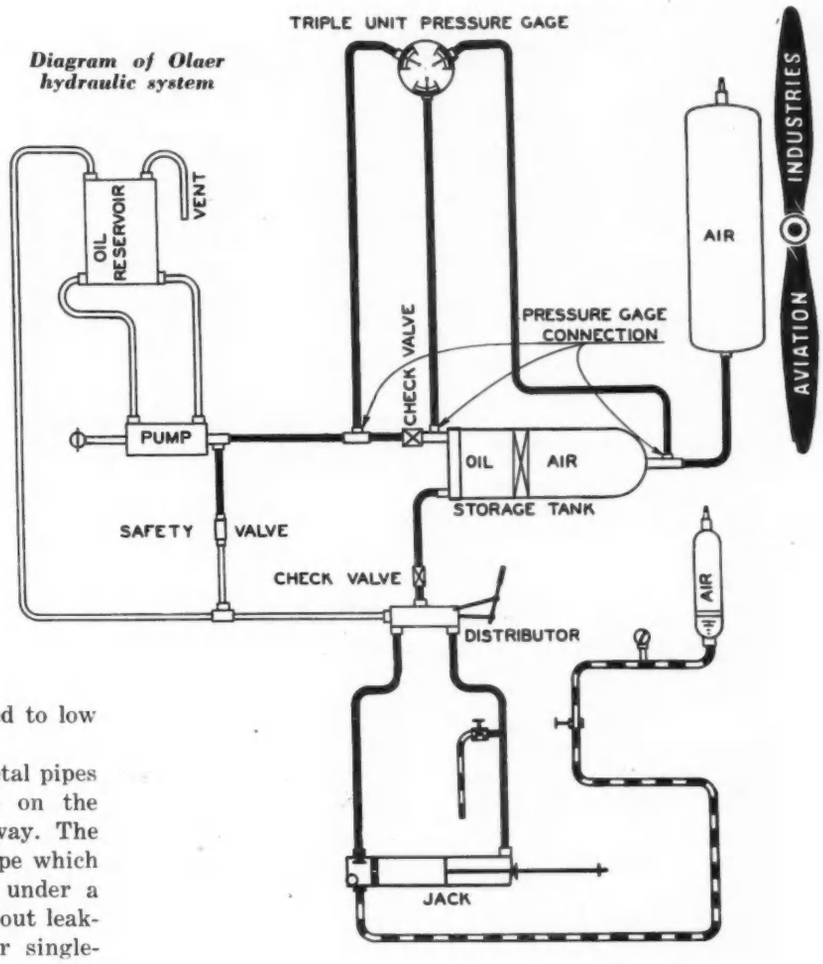
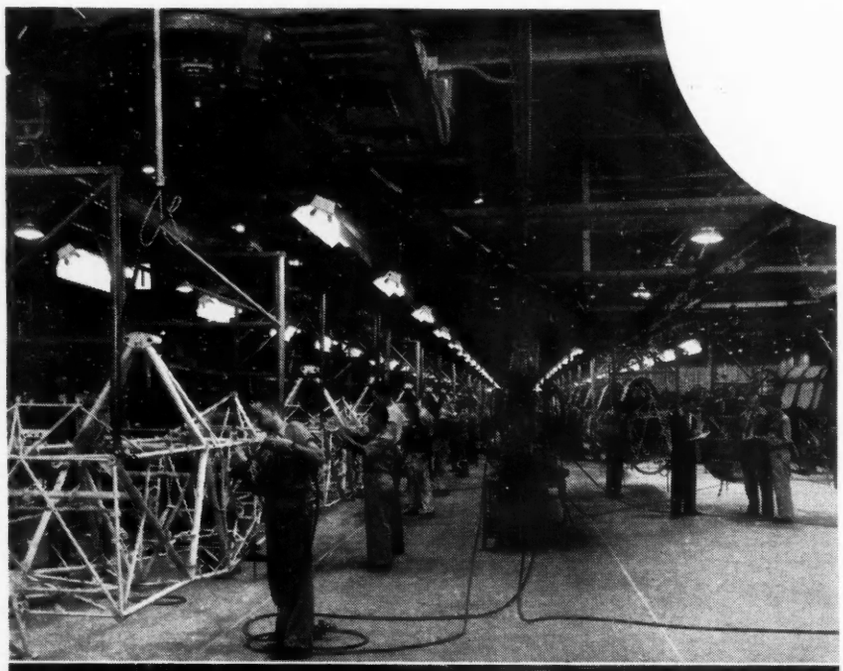


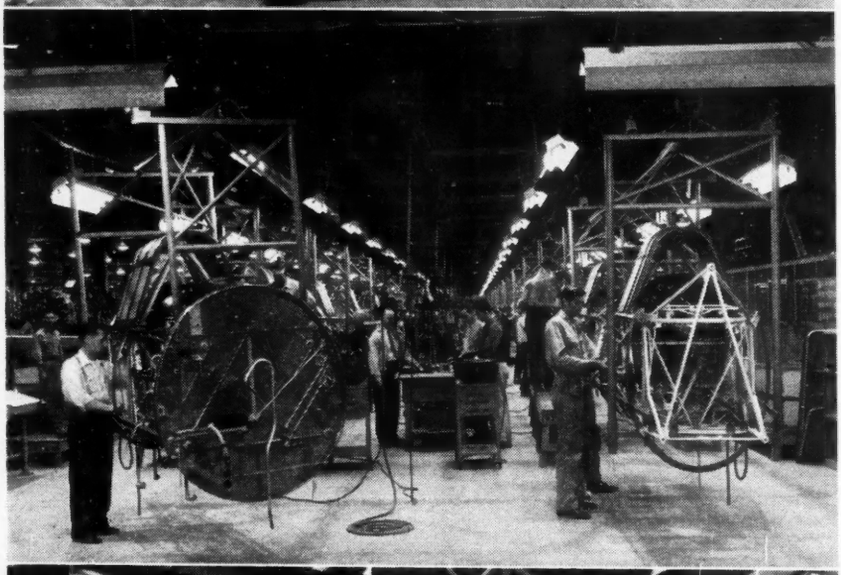
Diagram of Olaer hydraulic system

The Berger engine starter used with this system was described and illustrated in AUTOMOTIVE INDUSTRIES some years ago. It has double-opposed cylinders whose pistons are fitted with racks that mesh with a pinion on the crankshaft. This pinion is provided with an over-running clutch. When the liquid under pressure is admitted to the starter cylinders, the device spins the engine crankshaft, and springs return the pistons to the outer ends of their strokes. Liquid from all of the operating cylinders returns to the primary reservoir.

Soybean Lecithin as Stabilizer for Aviation Fuels

LECITHIN produced from Soybeans is said to have proved of value as a stabilizer for gasoline, and especially leaded gasoline. When leaded gasoline is exposed to sunlight, it may become cloudy, color changes may take place, and the fuel tank may be subjected to corrosion in the presence of moisture. In one particular case the addition of 10 lb. of soybean lecithin to 1000 barrels of aviation gasoline is said to have prevented the formation of precipitates. The corrosion-inhibiting properties of lecithin are especially valuable in the case of aircraft, which usually have fuel tanks made of sheet aluminum.





MASS

By T. R. BYL*

LINKED to the ever increasing tempo of defense requirements by means of a mile of overhead conveyor tramrail, the Vultee Aircraft Plant at Downey, Calif., features the first powered final assembly line in the aircraft industry. The new production line provides for a synchronized flow from the smallest parts to the finished plane as it takes off on its first test hop.

Upon receiving orders for the largest number of one type of plane (basic trainers) ever placed by the Army Air Force, Vultee's management decided upon the application of mass production principles. The results obtained to date have definitely proven the principles are adaptable to the manufacturing of aircraft, thereby creating an entire new conception of the manner and speed with which airplanes can be produced.

Visualize a river with tributaries feeding into it and the tributaries being fed by innumerable small streams, all flowing smoothly to the sea, and you have a picture of the flow of parts and planes through the Vultee plant under mass production principles.

Flow to the final assembly is supplied from five major sub-assembly lines. The fuselage sub-

* Plant Engineering Dept., Vultee Field Division, Vultee Aircraft, Inc.

(Top) View at left shows the first operation on fuselage. View at the right shows the fuselage switching off the conveyor line after completion of 25 operations and being checked into its position on the final assembly conveyor line.

(Center) "Half-way" point on the fuselage assembly line, where an inspection point is located as the line turns toward the point of final assembly.

(Bottom) General view of the tail assembly section of the conveyor line. At the series of stations on this section of the line the monocoque, horizontal and vertical stabilizers, rudders, elevators and tail wheel are assembled into one complete unit for attachment to the fuselage.

PRODUCTION of Airplanes

assembly complete from rudder pedals to the sliding canopy covering the cockpit starts the final line. The monocoque sub-assembly, complete from fairings on the control surfaces to the cable rigging, meets the fuselage. Next the center section sub-assembly, complete to the landing wheels, slides into place. As the unit travels down the line, the control cables, electric wiring and plumbing between the various sub-assemblies are connected. The next major sub-assembly to feed into the final line is the power plant, which is also a unit complete in itself, ready for connection to the controls and instruments in the cockpit, the fuel lines, etc. As it advances toward the ramp the outer wings and propeller are attached, and in an almost unbelievably short time a plane has been built up from major sub-assemblies and is ready for its test hop.

Each major sub-assembly line retains a small bank of finished assemblies, which act as a reserve to assure continued production along the final line. These lines are backed up with a reserve of processed and fabricated parts flowing in from the machine shop, sheet metal department, welding and many other departments, as well as from outside sub-contractors.

Along the production lines each operator performs a specific increment of work on each assembly as it passes by. Through constant repetition of his work a man acquires a dexterity that would be practically impossible by other methods. Because a worker is required to perform but a few definite operations the training period is short. Operators become proficient at their jobs in a matter of days as compared to months or years under old methods of aircraft production.

In order to obtain maximum speed and efficiency and assure uninterrupted production along the lines, man power and stock are pre-positioned. Each operator is stationed along the conveyor line with a stock of materials placed in a convenient rack immediately adjacent to him. He is provided with power hand tools wherever such tools will expedite work. The assembly lines are illuminated with daylight type of light 24 hours a day. The working height and positions along the conveyor are such as to minimize fatigue.

The parts in their flow from the various fabricating departments are moved along their way on skids, by truck lifts, trolley chain conveyors and tramrail. Nearly all parts on their way to the assembly line pass through one of the processing departments and paint rooms. Handling equipment of overhead type is used in these departments because it relieves congestion by affording a clear floor at all times. By providing the proper handling equipment in the processing departments, the operators are able to process a larger quantity of parts at one time. Fabricated parts receive a coat of primer paint on a powered chain trolley conveyor, which enables skilled painters to devote all their time to applying paint. Overhead tramrail is used exclusively for the handling of parts through the color paint rooms for the same reasons.

Because aircraft assemblies are of light weight metal, every effort is made to protect them from damage in transit. One method employed at Vultee to insure against injury from handling is to keep the assembly in its carrier from the start of the operation until it is bolted securely in its final position on the plane. The hazard of dropping is eliminated because the carrier is always on the tramrail. This fact also reduces danger of bumping, since assemblies travel a definite route which can be kept clear of foreign objects and other assemblies.

The bulkiness of the assemblies and the fact that parts are attached at almost any angle and any position makes it imperative that the worker have free access from all directions. Tramrail carriers lend themselves ideally for this purpose. The worker may reach underneath to install a floor board just as easily as he can reach over to put in an instrument panel, or he may stand in the center of the fuselage tube structure to install a rudder pedal.

Stability is essential while making many of the precision installations, and is obtained on the tramrail carriers by means of an out-rigger arm which rides on a stabilizing rail. This method provides greater stability than that attainable on the conventional castor dolly with wheel locks. Where stability is not required the extra rail is omitted. At certain times a free swinging carrier is of a distinct advantage, such as when two assemblies are brought together for attachment to one another; the bolt holes are more readily alined.

Tramrail sub-assembly lines at Vultee are laid out in the form of a loop, the finished assembly being switched off the loop at the same point from which it started. For example, the fuselage assembly is a loop of tramrail 250 feet long by 15 feet wide. On the inside of the loop is a pusher chain which operates in a horizontal plane. An outrigger stabilizing rail is located on the outside. The incoming carrier with bare tube structure is switched into the loop on one side of the end curve. A pusher arm on the chain engages it and propels it around the loop, where fabrication takes place, and pushes it off on a spur track as a finished assembly.

The loop layout has many advantages for sub-assembly lines. The problem of returning empty carriers is non-existent if the departmental layout is coordinated with rail layout. Floor space requirements are at a minimum, since one trucking aisle serves both sides of the loop. Pusher type chain drive is used most

(*Turn to page* 52, *please*)

AVIATION INDUSTRIES

Airbriefs

By HENRY LOWE BROWNBACK

Photography Goes to Work

Photography has many applications. Today it is saving months of time and countless thousands of dollars in the production of Lockheed airplanes. Drawings for templates and even pieces to be cut out are made full size and are photographed on 14 in. x 17 in. plates. This image is then projected on sensitized metal and the parts cut out directly instead of each template having to be laid out on the metal from the drawing. At the same time as the sensitized metal plate is made, a sensitized tracing cloth is printed to make the tracing. This process is used to reduce full-sized parts to model dimensions and test models to full sized parts. We may see a great deal of this soon in many industries.

Progress

Aviation is a dynamic—not a static science. Therefore "freezing" of design or methods means retrogression. To see the proof, we have but to look at Italy. In the early "thirties" Italy had forged ahead in aircraft design and construction. She had won the Schneider Cup, her great seaplanes had flown the oceans in formation, her fighting planes were the best in Spain. So, convinced of her superiority she froze her designs, and now is far behind the other first-class nations in aviation.

Germany is keeping her designs fluid. She produces in quantities in her production factories but, in other plants, far away from her production plants, she makes and tests new models and then builds the tooling for them so that any change-over can be made rapidly and the research men are left, unhindered by precedent, free to work out new worries for the world.

Air Brakes

We are not speaking of wheel brakes, but those types which people who like technical terms call "aerodynamic brakes." There is an ever growing school of thought that fighter planes are more effective if their speed can be suddenly reduced to that of the plane which they are attacking, at the moment of attack. Many fighters being used in Europe are fitted with aerodynamic brakes for this purpose. I can remember many conversations in France when this, then a theory and now a recognized fact was being discussed and the design requirements for the controllable pitch propellers for use on fighting planes were being determined. One of these called for an almost instant change from flying to reverse position, another for weights far lower than those associated with most American propellers, another for a hollow propeller shaft through which a cannon could shoot, another for the perfection of a lightweight blade for fighter planes and for the propellers to be used on large bombers with geared engines.

Many designs originating in every country manufacturing aeronautical apparatus were submitted—French, German, Italian, British, American—with every type of operation from mechanical, electrical, hydraulic to thrust control and every possible blade material. But one type met the specifications and stood the test, a French mechanically operated (planetary gear train) propeller made by one of the world's oldest manufacturers. This propeller, unfortunately, was put in production too late to be fitted to all of the fighting planes, but it made a splendid record.

Challenge

To meet the challenge of the new high altitude German fighters and bombers, the British have turned out a fighter, the Hawker Typhoon—powered with a 2350 hp. Napier Saber engine, which has twin propellers turning in opposite directions on the same axis. This engine is very compact and gives the pilot good forward visibility.

Although large radials are being used everywhere with marvellous results on transports, bombers and twin engined fighters, here, we have no very high-powered small frontal area engines ready for production and any freezing of designs simply to permit the quantity manufacture of what we have either in fighting or training aircraft might easily put us in Italy's plight. There should be a government agency charged with the task of keeping the whole aviation effort fluid.

Flutter

A few years ago, several transport planes on the West Coast crashed from a mysterious failure of the tail structure due, it was discovered, to flutter. Recently a great bridge swayed, twisted and crashed in a windstorm due to—flutter.

Now leading aeronautical engineers predict that unless some mathematical determination of its effects can be deduced, airplane design progress may be blocked by flutter. Recently, experiments were carried on at Harvard to determine some facts about flutter and among the interesting ones discovered were that at angles of attack above the positive and below the negative stalling angle, the flutter speed is decreased to about one-third that of the unstalled wing. This flutter may be associated with an instability, which arises and is indicated by a negative slope of the wing lift curve. These facts may explain the loss of control in some stalled planes resulting from the structural collapse of parts which, it had been thought, were broken by a too-brusque manipulation of the controls by the pilot.

Dies

Much interest has been shown in the dies used by the aircraft industry as those used in the motor car industry take months to make and are terribly expensive. The dies used for the pressing of aluminum alloy are usually made of a zinc alloy. Some lead-zinc alloys are used, but the promising material for female dies seems to be an alloy made of almost pure zinc with aluminum, copper, and magnesium as alloying ingredients.

Caproni Bomber

Caproni has adopted the radial type of engine for his new bomber, the Ca135. It is to be noted that, all over the world, preference is shown for Vee engines in single engined fighters and most multi engined planes carry radial aircooled engines. The Caproni shows evidence of the scarcity of aluminum in Italy as it is built with a welded steel tubing fuselage and wooden wings, fabric covered.

New 2-Seater Fighter

The Luftwaffe is now using a new twin engined 2 seater, heavily armored fighter as a bomber escort. This plane —the Focke-Wulfe FW 187—is powered by two liquid-cooled Mercedes-Benz engines.

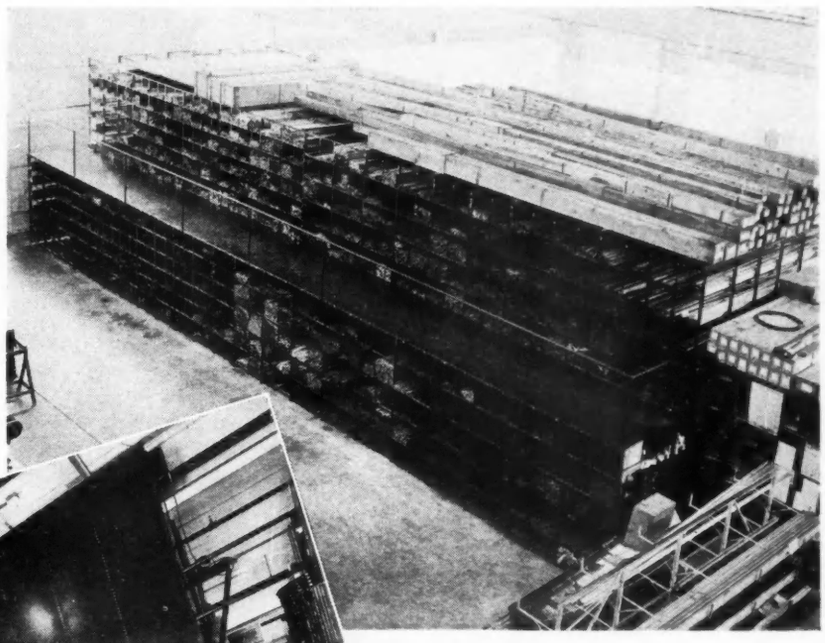
New Stockrooms Save Floor Space

at Douglas El Segundo Plant

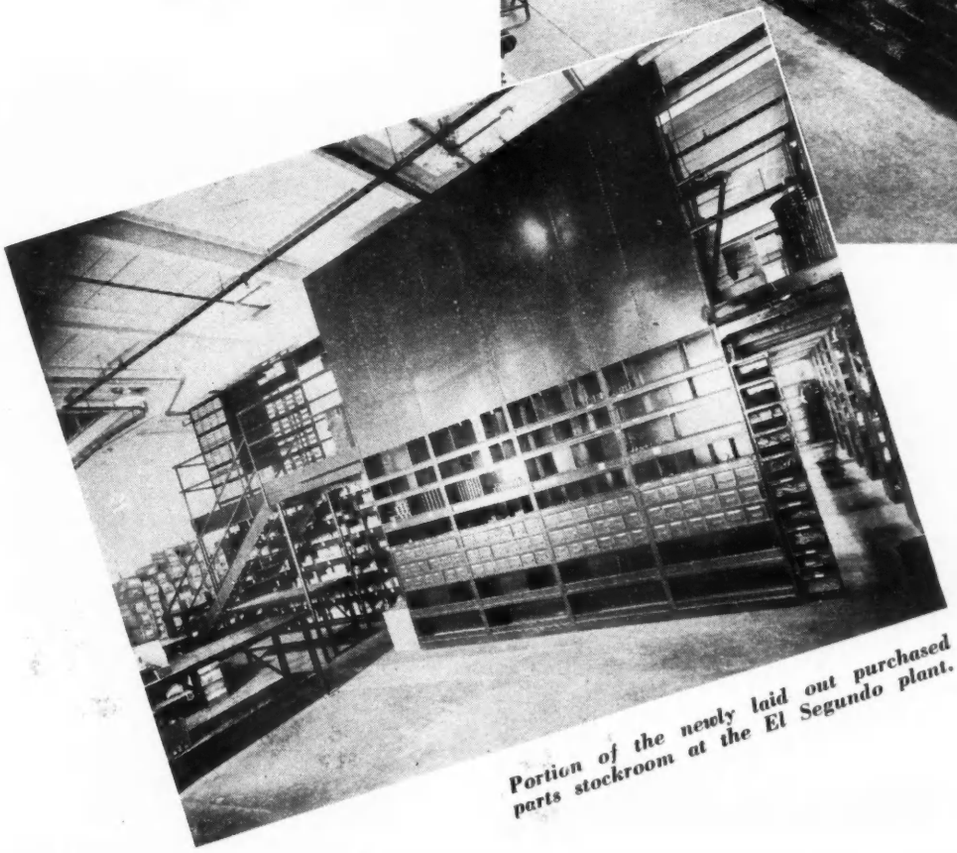
AT THE El Segundo plant of the Douglas Aircraft Co. in California, the new stockrooms now in use are laid out and equipped to effect a saving of considerable floor space, thus making available more room for production machinery and assembly lines to help step up the output of dive bombers. They occupy two-thirds the space formerly required and can hold 25 per cent more material.

The plant has two modern stockrooms, one for purchased parts and the other for bar stock, tubing and extrusions. The purchased parts stockroom, which covers 3600 sq. ft. of floor space as compared to 5400 sq. ft. by the replaced stockroom, is located in the center of the factory, between the two production lines and convenient to all production departments.

The arrangement of the bar stock, tubing and extrusions stockroom is based on the "wedge-lock" installation. It is said to be the first in the aircraft industry on the Pacific Coast. By utilizing ladders on rails and platforms integral with the racks, every bin is readily accessible. The racks are reinforced to give them a capacity of more than 600 lb. per cu. ft.



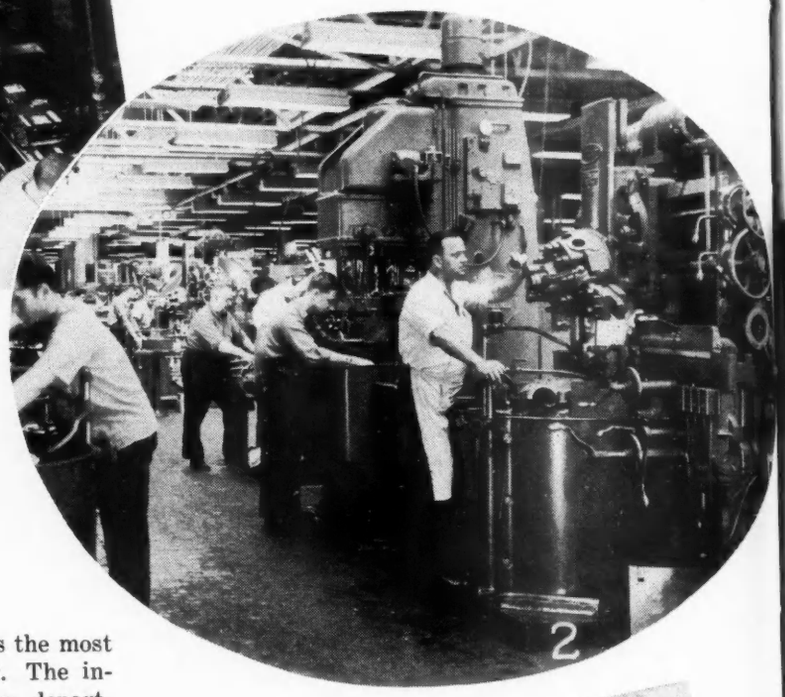
Here is a section of the El Segundo bar stock, tubing and extrusions stockroom. Note the platform for easy access to the material in the upper bins.



Portion of the newly laid out purchased parts stockroom at the El Segundo plant.

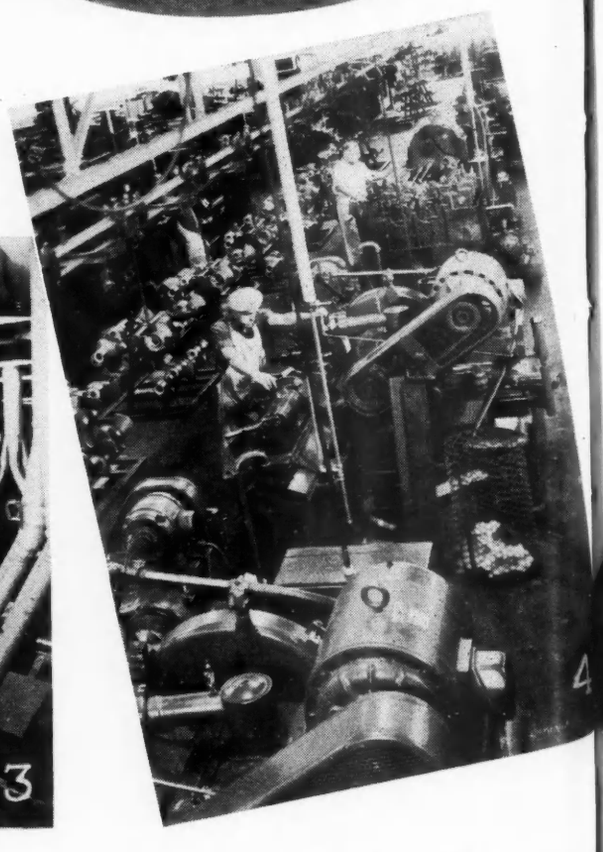
AVIATION INDUSTRIES

Packard's



THOUSANDS of intricate machines and tools now are teeming with activity at Packard's new Rolls-Royce plant in Detroit as mass production of the 1300 hp., liquid-cooled Merlin engine gets underway for the British Air Ministry and U. S. Army Air Force. Official dedication was held early this month.

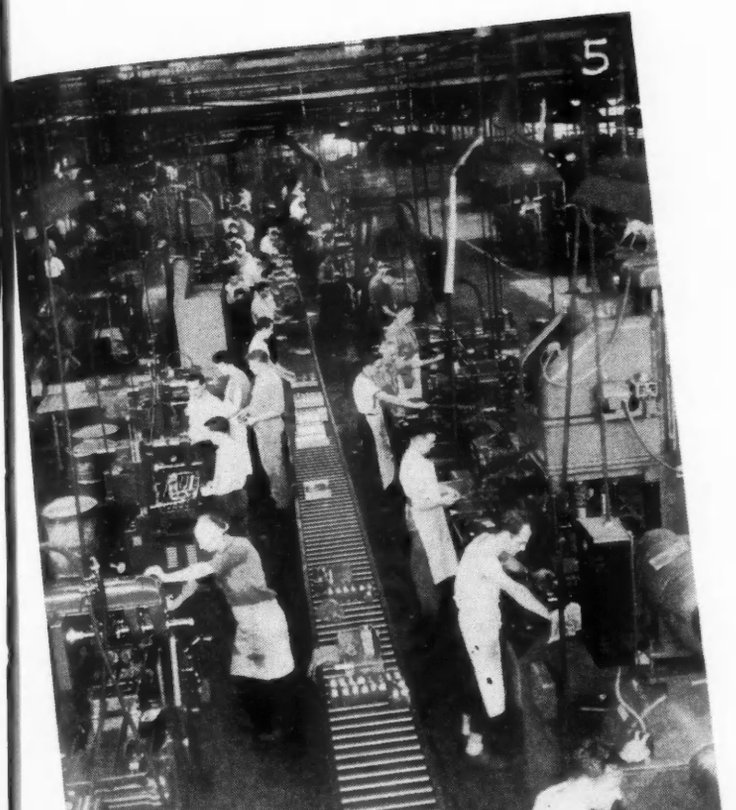
This plant is new from the ground up and features the most modern production equipment built in this country. The inspection departments, final assembly, and tear-down departments are completely air-conditioned. Daylight visibility is afforded by one of the most modern fluorescent lighting installations to be found in the U. S.



Rolls-Royce Plant

1 *Looking down the piston machining line. A battery of Milwaukee Model H milling machines may be seen along the windows at the left.*

2 *Here is a view in the department for machining the supercharger casing. Immediately in the foreground are a Bullard V-T-L machine and a multiple spindle Natco.*



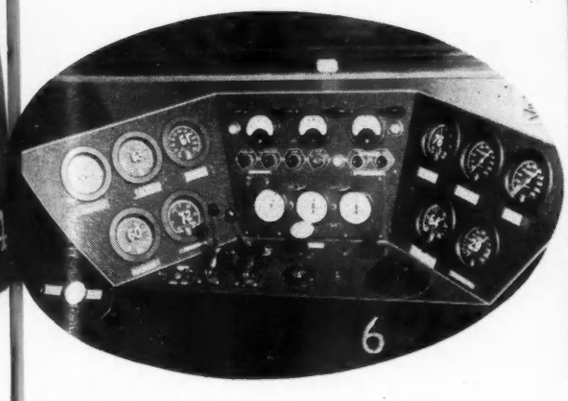
3 *Huge department for buffing and polishing the parts of the engine to the super-fine finishes and tolerances demanded by the flying services. The comprehensive system of exhaust ducts not only does protect the health of the workers, but it prevents the contamination of the atmosphere by fine abrasive dust and metallic particles.*

4 *A view of the crankshaft department, showing the massive shafts feeding along on the overhead monorail conveyor. The crankshafts are nitrided to the required hardness in Westinghouse nitriding furnaces of the latest type, in a time cycle of 84 hours.*

5 *Looking into the department for machining the bearing blocks for the forked rods. Note the gravity roller conveyor for moving the work from one machine to another.*

6 *Master control board outside each of the test cells, where every engine must pass gruelling tests before receiving final O.K.*

7 *Row of booths where aluminum castings are thoroughly cleaned with emery, wire wheels and rotary files before machining. Powerful suction exhausts the contaminated air from each booth.*



Automotive MATERIALS 54

New Carburizing Compound

A NEW compound used for carburizing steel parts has been introduced by the Lithium Co., Newark, N. J. The Lithco compound is said to completely neutralize the atmosphere in the furnace so that no scaling can take place and decarburizing reactions are prevented. The process in which this product is used, known as the Lithcarb process, is claimed to provide fast, bright gas carburizing without scale, soot or tar formation. Because reversible reactions of the carburizing cycle are eliminated in the Lithcarb process, the steel is said to take on carbon continuously and the carburizing time consequently is cut to about one-third. Another advantage claimed for the Lithcarb process is that no sand-blasting or other handling operations are necessary for final finishing.

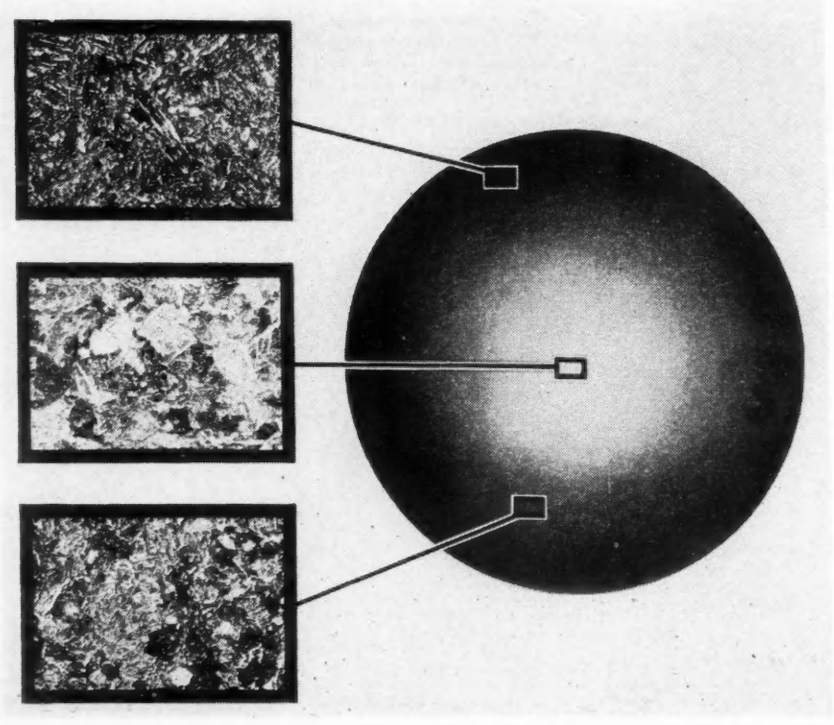
Timken Axaloy Steels

NEW alloy steels to take the place of nickel steels formerly used in axle shafts and for similar purposes have been developed by the Timken-Detroit Axle Co. and have been given the name Axaloy steels. We are informed that in torsional fatigue tests in the laboratory, axle shafts made from the new Timken Axaloy 140 steel showed a definite superiority over shafts made from other steels. Timken Axaloy 325 and 420 are said to have proved superior for the gears of final drives, which must have exceptionally hard surfaces to resist wear and must be able to resist shock load without tooth breakage. The new alloys are already being used in Timken axle shafts and final-drive gears and will be introduced for other axle parts as rapidly as production facilities permit.

Seeking Industrial Applications for Silver

THE American Silver Producers' research project, sponsored by several silver producing companies in the United States, has completed a year of activity at the Bridgeport plant of Handy & Harman. The project was formerly located at the National Bureau of Standards, Washington, D. C., but was reorganized June 1, 1940.

In recent months the scarcity of many base metals has focused attention on the use of silver as a substitute for aluminum, nickel and tin. In places where sheet or foil aluminum has been used, for its corrosion resistance or high reflectivity, silver plating on available metals can be substituted, since it possesses these qualities, for most purposes, to an even better degree than aluminum. Silver electro-deposits are being investigated as a substitute for nickel, as an undercoating for chrome plating. A series of experiments are under way to determine what advantages may be derived from the

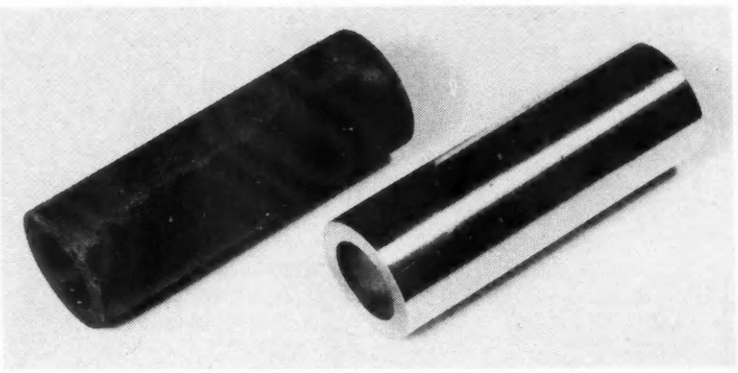


Cross section of a Timken Axaloy shaft with micro-structure photographs at three points to illustrate its desired characteristics of uniformly decreasing hardness from the outside to the center.

use of a corrosion-resistant electroplate of silver followed by a hard, wear-resistant chromium deposit.

The project has also conducted experiments to determine the strength of extruded tubing made from a 3.5 per cent silver—96.5 per cent tin alloy. A bursting strength of 2500 lb. per sq. in., or almost double that of pure tin, was obtained, and this is apparently far in excess of any working pressure encountered in distilled-water lines where this material is finding commercial use. Tests on threaded joints showed that the alloy had a tensile strength 25 per cent greater than joints made with pure tin tubing. For certain installations it would seem feasible to use threaded connections in distilled water lines if the tubing were made of the silver-tin alloy. Both the 3.5 per cent silver and 5 per cent silver-tin alloys are finding applications as solders.

Interest continues in the possibilities of using lead-



The bright part (right) required three hours furnace time when carburizing it by the Lithcarb process as compared to eight hours for the gas carburized part (left).

silver solders in place of the standard lead-tin alloys in automatic can-making machines. A large saving of the strategic metal tin would result by this substitution. The 2½ per cent silver-lead alloy is said to be cheaper than the standard 50-50 solder, and equally satisfactory joints can be obtained.

The Silver Project's Fellowship at Lehigh University has continued with corrosion studies of silver. The corrosion tests made include not only a study of different chemicals, but also a study of a large number of different commercial products which may be manufactured in silver equipment or packaged in silver containers.

Improving Machinability of Stainless Steels

THE ADDITION of small amounts of bismuth, 0.1 to 0.5 per cent, to the corrosion-resistant stainless alloys results in a remarkable and useful increase in their machinability. This was brought out in a paper contributed by H. Pray, R. S. Peoples, and F. W. Fink, of the Battelle Memorial Institute, Columbus, Ohio.

The possibilities of improving the machinability of stainless steel were investigated at the Battelle Institute for the Alloy Casting Institute, and the investigators were given to understand at the beginning of the project that any improvements in machinability would be acceptable only if they were attained without material sacrifice in corrosion-resistance or mechanical properties. The paper contained laboratory data relative to the effect of bismuth on the machinability, corrosion-resistance, the physical properties at ordinary and high temperatures, galling resistance and hot-working properties of several of the more common stainless alloy types.

Immersion Tin Finish for Copper and Brass

THE Alrose Chemical Co. of Providence, R. I., announces Bon White, a new immersion tin finish, applicable to all copper and brass surfaces. Bon White, it is claimed, may be applied in ten seconds and can, in many instances, replace slow boiling methods of tin plating. Bon White solution is prepared by dissolving 16 ounces of sodium cyanide and 6 ounces of Bon White paste in 1 gal. of boiling water. When cooled to room temperature, no further heat is necessary and no adjustment is required, as the material is completely plated from the solution. The life of the solution depends on the production volume. Enamel and glass containers are used, and the work can be handled in baskets or on wire. Bon White is claimed to assure an inexpensive, highly effective white finish and, being pure tin, to offer considerable tarnish resistance.

New Extruded Plastic

A NEW plastic which is supplied in extruded forms is announced by Mack Molding Co., Wayne, N. J. It can be made in most any design, with or without fastening channels, or in tubing or strip. The new product is a possibility for automobile decoration.

Fabrics Coated with Synthetic Rubber

FABRICS coated with Ameripol, its recently introduced synthetic rubber, have been announced by the B. F. Goodrich Co., Akron. One of the applications of such coated fabrics is to fuel pumps handling oil, high-test gasoline, alcohol, etc., which attack rubber. Balloon cloth is used for the lighter gage fabrics, while light-weight ducks and sheathing are used for the heavier gages, which range from 0.008 to 0.050 in. Standard widths of these fabrics range from 35 through 49 in., the approximate weights per lineal

(*Turn to page 54, please*)

New Ideas in a Small

AT THE Buick Motor Division of General Motors, light case hardening of a wide variety of small steel parts is being accomplished in a new type of continuous gas furnace embodying a number of constructional and operating innovations.

Parts to be treated are pushed through the furnace in trays, two rows of which ride side by side on alloy steel rails resting on structural cross members. Each row includes 28 trays, 12 x 18 in. in size. They are moved by a pusher mechanism at the charging end which exerts pressure on the two trays being charged and thus moves the entire row of trays and discharges a pair onto the quenching fixture at the discharge end. No conveyor chains or dogs are required inside the furnace.

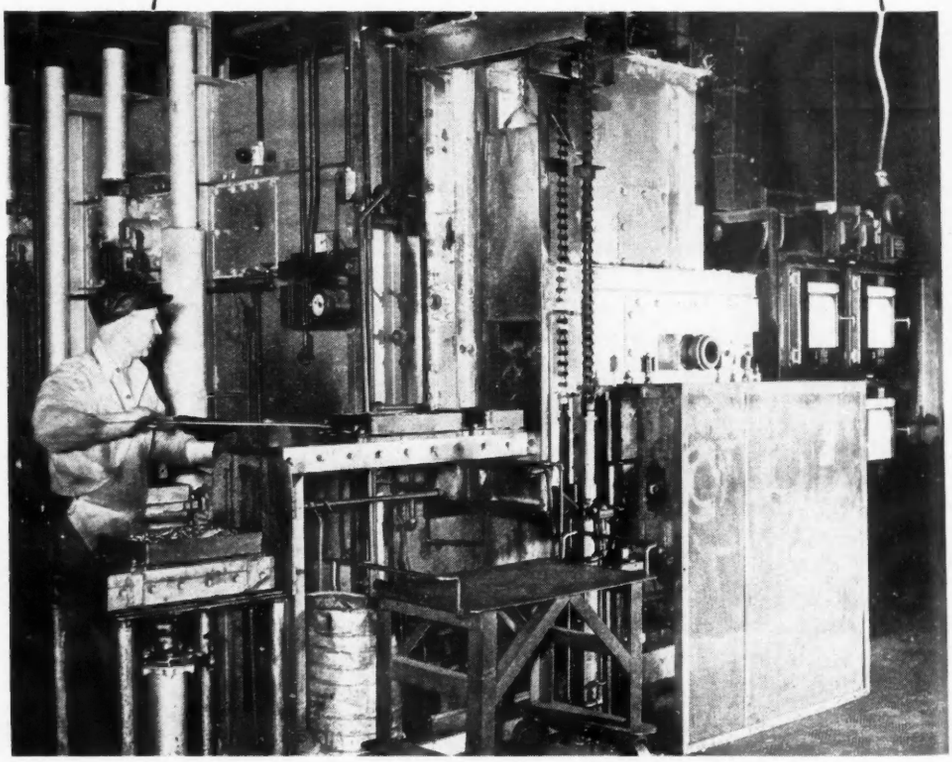
The furnace case is sealed tight. It is fired through 20 return bend U-tubes heated through low-pressure gas burners. Seven burners fire on each side of the charge; three fire below on one side and two below on the opposite side. These are at the front or charging end of the furnace. One burner fires below the charge near the discharge end. Temperatures are controlled in three zones of the furnace, the operating temperature being in the range 1500-1525 deg. Fahr.

The radiant tubes are 5 in. in diameter and exhaust into short vertical stacks outside the furnace on either side.

The trays are made either to hold a loose charge of small parts, or a racked charge of parts, the latter being supported in an alloy grid placed over the top of the tray. Open mesh bottoms and perforated sides permit ready passage of the carburizing gas. The trays are kept lined up inside the furnace by means of lips on the two outside rails on which they travel. The center rail has a double web and is flat on top. Each tray carries an average load of about 40 lb. The capacity of the fur-

Parts Processed in the Furnace
the steel from which they are made and details of the heat treatment:

Part	Steel	Type of case
Clutch release yokes	S.A.E. 1010 with 1112 pins	0.007 min.
Selector shafts	S.A.E. 1112	0.007 min.
Shifter rails	S.A.E. X1315	0.007 min.
Shifter control levers	S.A.E. 1010	File hard
Pushrod lower ends	S.A.E. 1112	0.007 min.
Pushrod upper ends	S.A.E. 1112	0.007 min.
Valve adjusting ball studs	S.A.E. 1112	0.007 min.
Brake pedal pins	S.A.E. 1115	File hard
Propeller shaft couplings	S.A.E. X1345	Harden—no case
Flywheel ring gears	S.A.E. 1045	Rockwell C37-40 on teeth
Oil pump shafts	S.A.E. X1015	0.010 min.
Knuckle spindle nuts	S.A.E. 1112	File hard
Clutch release lever pins	S.A.E. 1112	File hard
Steering knuckle support nuts	S.A.E. 1112	File hard
Oil pump idler gear pins — first carburized with 0.020-0.030 case	S.A.E. X1015	File hard
Oil pressure valves	S.A.E. X1335	Rockwell C40 min.



Charging end of furnace from generator side, showing two trays entering vestibule

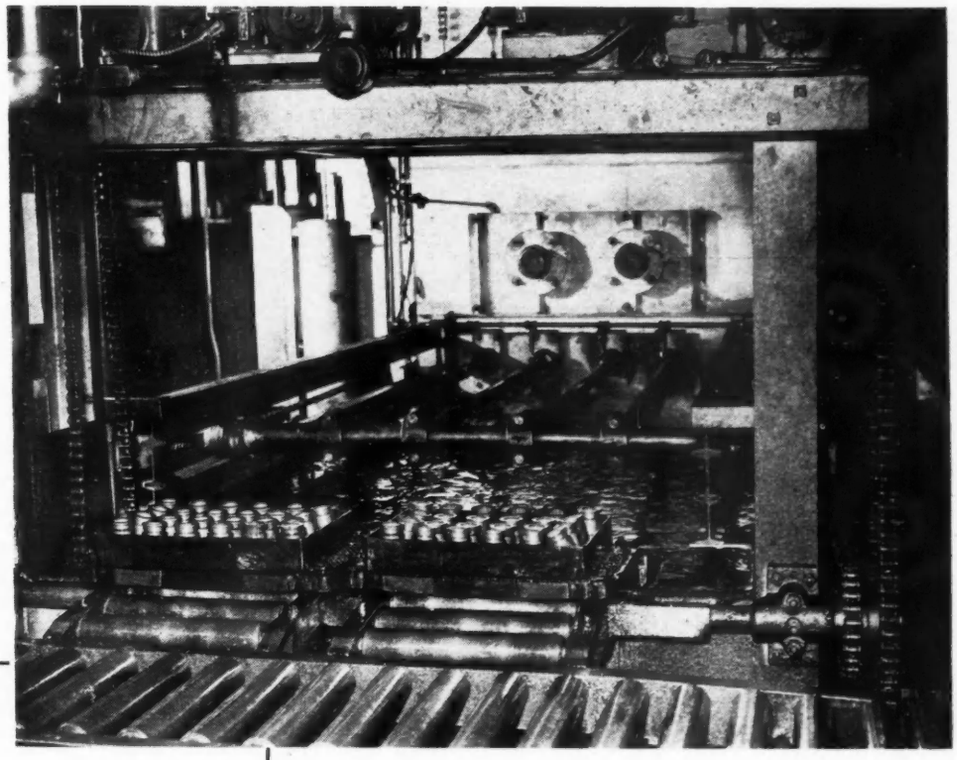
Parts Hardening Furnace

nace is 1500 lb. per hr., allowing 1½ hrs. in the furnace at 1500 deg.

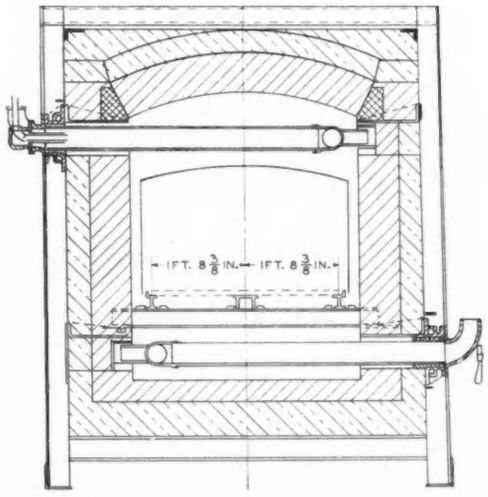
The hardening gas used is a mixture of prepared gas, city gas, propane and ammonia, in the following typical proportions; the figures being hourly consumption:

Prepared gas .700 cu. ft.
City gas .....200 cu. ft.
Propane ..... 14 cu. ft.
Ammonia ....180 cu. ft.

The gas is prepared in a patented generator in which city gas and air in proportions of 1.7 parts of air to 1 of gas are partially cracked inside an alloy bottle which is heated externally. After cracking the gas, the mixture is passed through a dehydrator and then through charcoal which builds up the CO_2:CO ratio. Gas is admitted to the furnace through three sealed inlets at the side, just above the level of the tops of the trays. Circulation is provided by three power-driven fans set in circular openings in the refractory bottom of the furnace, about 18 inches below the rails. The motors for the fans are outside the furnace and their driveshafts are sealed with bushings to prevent gas leaks. A Selas "flo-scope" is attached to the generator to indicate flow rates of the various gases.



Discharge end, showing quench tank and trays coming out of oil



Details of the small parts hardening furnace being used at the Buick plant

Six ammonia tanks are manifolded in a bank. Three are in use at one time. It was found necessary to use three tanks because with only one supplying gas, it would tend to freeze up because of too rapid flow. The gas passes through a pressure regulator, with the flow gaged by a manometer.

The pressure of the carburizing gas is regulated at from 0.15 to 0.30-inch of water. The pressure recording outlet pipe is located at about the center of the furnace, half way up the sidewall.

A vestibule is provided at the charging end to prevent loss of gas inside the furnace. An outer door is opened and two trays are placed in position on the rails in the vestibule. The door is closed and an inner door opened, following which the pusher mechanism starts its cycle and moves the line of trays ahead one position. A screw type pusher is used, controlled

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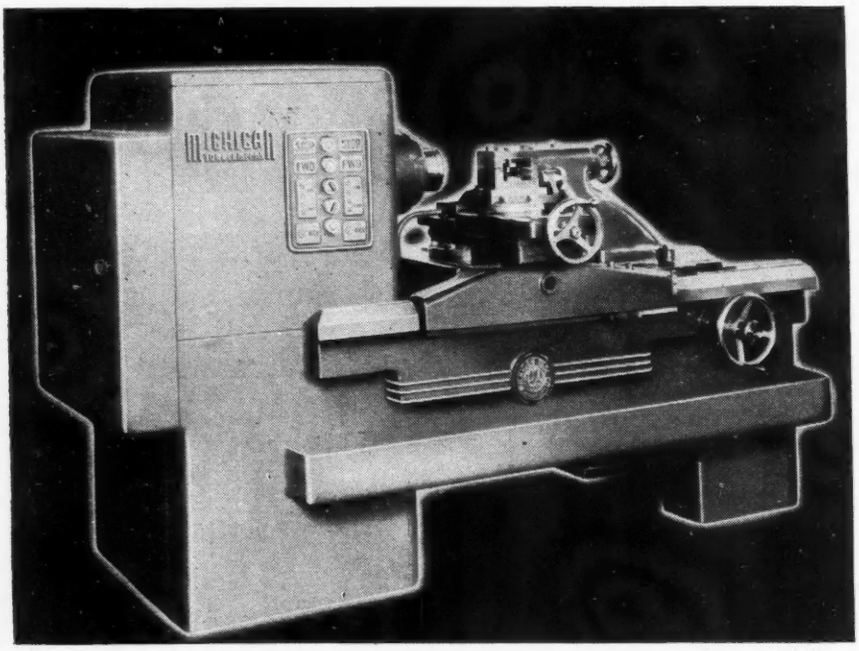


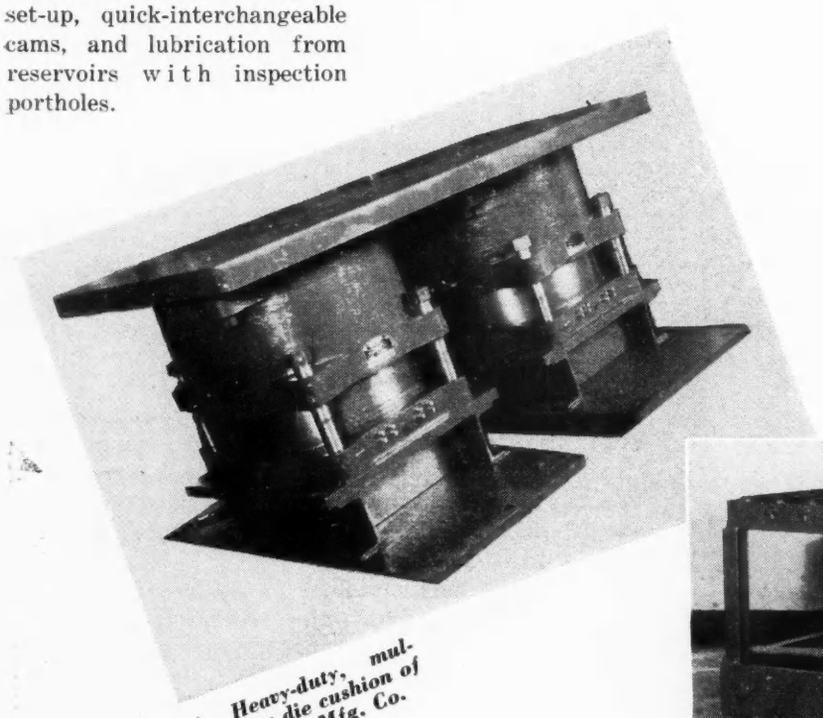
Michigan cutter-relieving machine.

The machine will handle work up to 8 in. diameter, with a maximum length between centers of 24 in. The number of teeth that can be relieved ranges from 1 to 24. Maximum relieving stroke is $\frac{3}{4}$ in. Five relief cams are furnished with the machine. The speed changes, both forward and reverse, are obtained through electrical control. Two reversible motors are coupled in such a manner that by operating either one or both motors, seven spindle speeds—four forward and three reverse—are available, the change being made while the machine is running.

A NEW universal cutter-relieving machine, the 1708-A, has been announced by the Michigan Tool Co., Detroit. The machine is suitable for relieving form, gear, and rack-cutting tools, end milling cutters, spotfacers, etc., with radial or side relief or both. Among the features of the machine may be mentioned a multiple range of forward and reverse speeds, a turntable for the cam slide, a universal adjustable tool box for quick set-up, quick-interchangeable cams, and lubrication from reservoirs with inspection portholes.

THE MODEL 2-C heavy-duty, multiple-mounting pneumatic die cushion manufactured by the Dayton-Rogers Mfg. Co., Minneapolis, Minn., is self-contained, carrying its own surge tank, and is now made in sizes up to 24 in. These cushions can be furnished in multiples of two, four, or six, having a maximum ring-holding pressure of 90 tons, with drawing capacity for deep-drawing shells up to10 in.

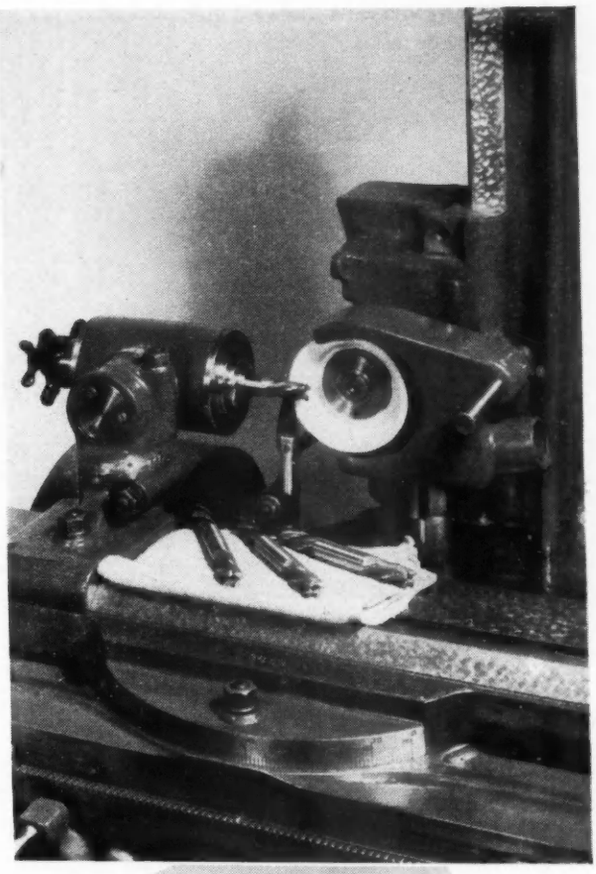
These cushions can be used for controlling the pressure pads, as well as in all forming operations. For each installation is supplied a combination regulating-reducing valve and pressure gage to maintain the correct draw-ring-holding pressure pad control throughout the work cycle, on a given job. The working pressure is indicated by the gage. This model is suitable for large straight-side presses for drawing and forming automobile body doors and similar parts.



(Above) Heavy-duty, multiple-mounting die cushion of Dayton Rogers Mfg. Co.

(Right) Liftable 5000 lb. capacity, with roller top.

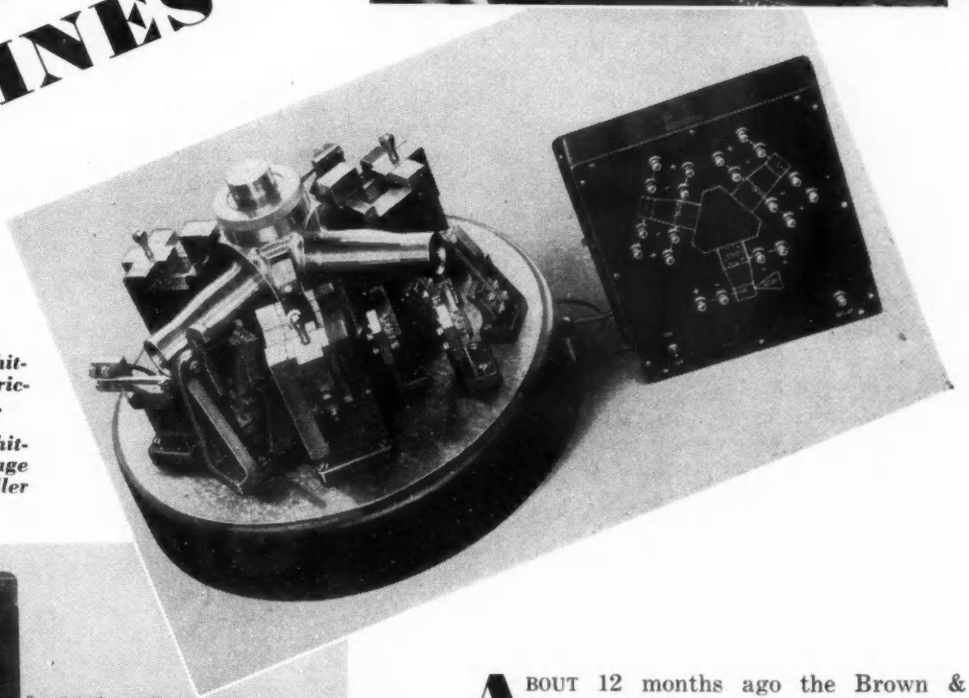
Brown & Sharpe end mill-sharpening attachment in grinder.



A NEW Liftable, with a capacity of 5000 lb., is announced by the Service Caster & Truck Co., Albion, Mich. Used as a feeding table for press work, the load is held at working level. Material need not be transferred from one truck to another.

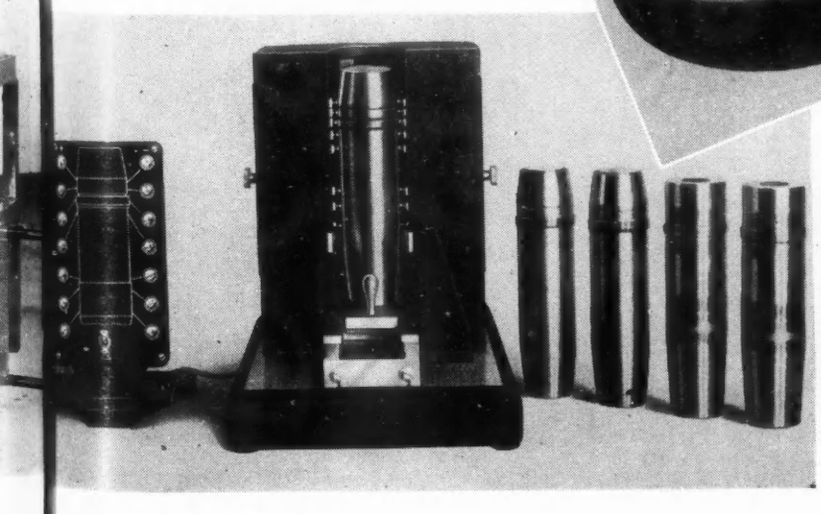
This truck is of electric-welded, all-steel construction. The table is raised and lowered by means of a vice-type handle. Its lifting mechanism consists of a steel screw which actuates the lifting chains. The table is locked at the working height by means of a cam lock. The model shown is 4 ft. wide by 5 ft. long, and its top consists of a double row of 2½-in. rollers running on sealed ball bearings. When extended, the height of the table is 36 in., when lowered, 24 in. A standard model of 2000-lb. capacity, with flat steel top, is also being offered.

MEN and MACHINES



(Below) Pratt & Whitney multiple electric-contact shell gage.

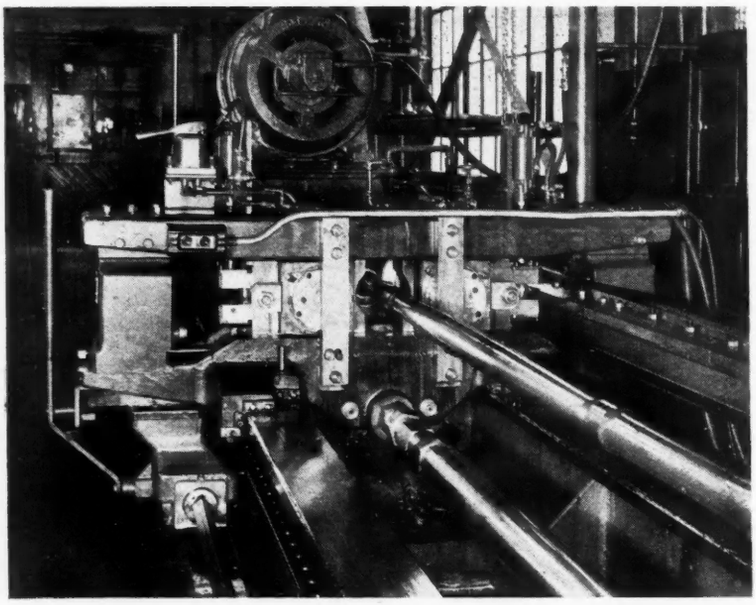
(Right) Pratt & Whitney electric-contact gage for checking propeller hubs.



ABOUT 12 months ago the Brown & Sharpe Mfg. Co., Providence, R. I., announced to the trade the Nos. 10 and 13 end mill-grinding attachments for grinding machines. These attachments have now been redesigned to permit of sharpening the end teeth as well as the peripheral teeth, and they are now known as the Nos. 10 and 13 end mill-sharpening attachments.

Referring to the illustration, a knob at the rear end of the attachment spindle

(*Turn to page* 54, *please*)



Close-up of the tool head, showing the spinning rollers at the center. Templates or cams for guiding the rollers for special formations may be noted at the right in the background.

Tubing in

THE DEWEY PROCESS of steel tube forming is based on a recently developed type of machine which produces all manner of special formations, necking, long straight tapers, etc. This process was introduced a relatively short time ago by Steel and Tubes Division of Republic Steel Corporation.

Since there is so much variation in tube sizes and lengths for different uses, a standard line of machines capable of meeting all requirements is not contemplated. It is more likely that possible users will be licensed and aided in the design of equipment adapted to their special needs.

By proper tooling and by suitable variations in the hydraulic cycle, the machine used in the Dewey Process will produce the desired formations in the tubing in the following unique combinations:

1. with uniform wall thickness for the entire shaped length,
2. with a reduction in wall thickness at the reduced section,
3. with a controlled increase in wall thickness at the reduced section.

The process is suitable for a great variety of automotive and other tubular parts including such applications as—aircraft struts and aircraft control elements, particularly for large commercial planes, and all manner of special parts which may require unique formations of every conceivable character and, possibly, even torque tubes and propeller shafts. Some idea of the scope of applications may be gained from the illustration showing some typical jobs produced both experimentally and for actual installation.

Perhaps the most valuable feature of the Dewey machine is its extreme flexibility, within the range of diameters and length that can be accommodated in a machine of a given size. The gamut of possible formations can be produced simply by changing the tooling and hydraulic cycle and this is accomplished so quickly as to make the machine suitable for small-lot as well as for mass production.

It can be tooled to spin special formations in any part of the tube or to produce a straight taper for the entire length of the tube or to generate a special mathematical curve, which in the case of a propeller shaft, for example, can be used to develop a beam of uniform strength.

The machine comprises, essentially, the following elements:

1. a slidable driving head;
2. a fixed tail stock with a freely rotating chuck;
3. the tool head;
4. fully automatic hydraulic controls and feeding mechanism, consisting of variable speed Oilgear equipment.

In operation, the tube is chucked at both ends, i.e., in the tail stock and in the driving head. The work is fixed at the tail stock but is free to rotate. The driving head turns the work and at the same time is slidable to accommodate the elongation of the tube. The sliding of the driving head is controllable for any desired operating conditions through the variable speed hydraulic mechanism. For example, in normal operation where it is desired to hold the wall thickness uniform, the head is free to slide without restraint, i.e., to idle.

Where a reduction in wall thickness is desired, the hydraulic mechanism imposes a tension on the tube by a positive pull on the head, controllable by the operator.

Where an increase in wall thickness is required, the hydraulic feed is impressed as a push on the driving head, or a compression of the tubing.

The operation of the tool head is most interesting. In the first place, it is fitted with a roller bearing, free turning bushing, which supports the full diameter of the tube at all times. The spinning rollers are located immediately adjacent to the bushing so as to perform the heavy drawing or spinning operation directly at

the region of support. Suitable templates, controlling the inward and outward movement of the spinning rollers along the path of the formation, are mounted on the slides or ways of the machine, transmitting the motion to the rollers through cams.

The operation is so arranged as to proceed always from the tail stock toward the driving head, thus impressing the maximum torsional effect of the driving head on the full diameter of the tube.

It is of interest to note that the design of the tooling is a fairly definite function of tube diameter and wall thickness. In addition, correction is made, experimentally, to make up for a certain amount of "spring-back" characteristic of any spinning or drawing operation.

During the forming, the rollers are flooded with a heavy stream of a strong soluble oil solution which serves primarily as a coolant but affords also a measure of lubrication.

Tube Shaping Data

Possible uses for tapered and shaped tubes made from welded or seamless steel tubes and from brass, copper, bronze, aluminum, nickel silver, monel or other metal.

AUTOMOTIVE

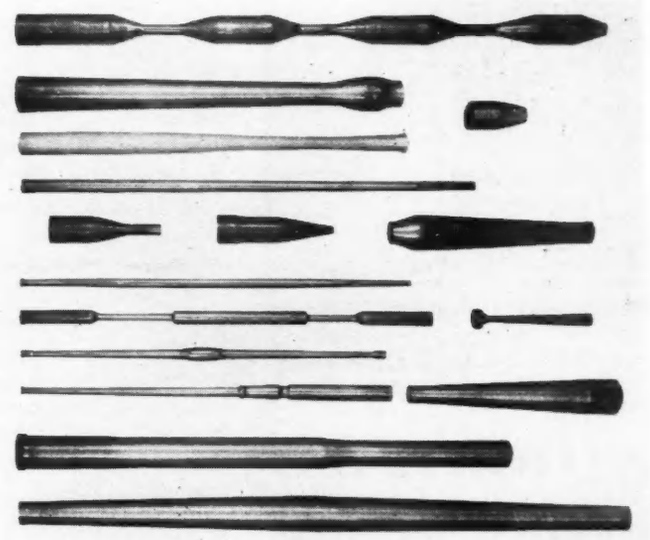
propeller shafts
mufflers
exhaust pipes
conduits
manifolds
steering posts
horns
braces
brake rods
control rods
axle housings
door handles
robe rails

AIRCRAFT

struts
braces
radiators
exhausts
mufflers
manifolds
radio masts
seats
propellers

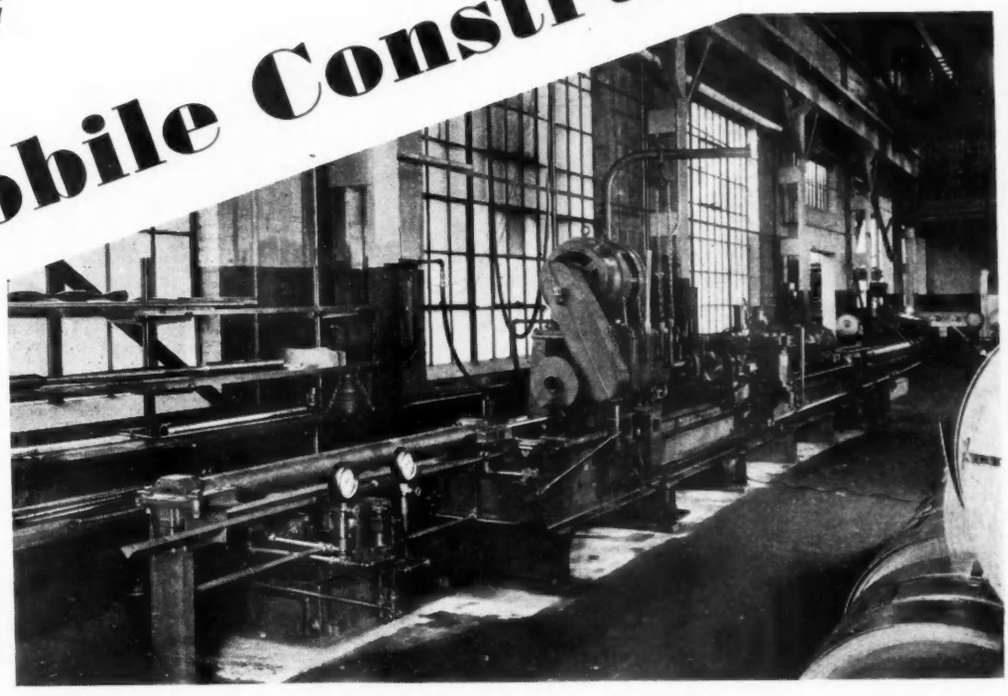
AGRICULTURAL TOOLS

cultivators
double trees
single trees
wagon tongues
mower tongues
harvester tongues
hand tools



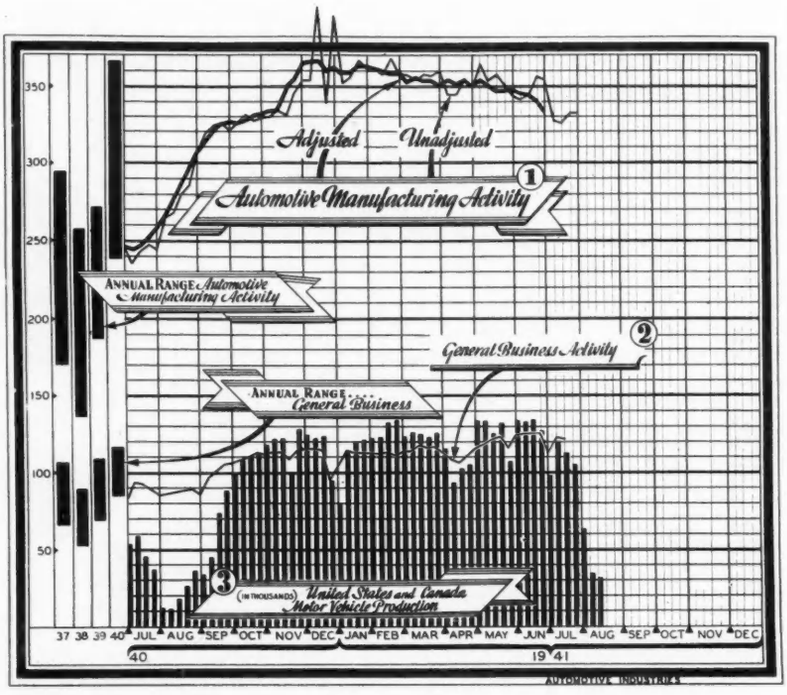
Assortment of samples of tubing formed on the Dewey machine, intimating an endless variety of applications and forms.

Automobile Construction



General views of the huge Dewey machine in operation in the Steel & Tubes plant in Cleveland.

[*Our own view of automotive production and sales: authoritative interpretation of general conditions*]



Weekly Indexes of Automotive General Business

Price Rise Estimated by General Motors Head

A PASSENGER car subcommittee of the Automotive Industry Defense Advisory Committee is now at work in Washington determining the extent to which 1942 model production can be cut with a minimum of unemployment before defense industry absorbs the workers and the least possible dislocation of industry. Members of this subcommittee are I. T. O'Brien, general production manager of Chrysler; R. C. Cosgrove, vice-president of Crosley Corp.; Donaldson Brown, vice-president of General Motors; T. W. Skinner, assistant sales manager of Ford; H. M. Northrup, chief engineer of Hudson; William Packer, vice-president of Packard; G. W. Mason, president of Nash-Kelvinator; Paul G. Hoffman, president of Studebaker, and J. W. Frazer, president of Willys-Overland. The subcommittee hopes to have a report ready before the model changeover is completed late in August.

An indication of increased cost of 1942 models was revealed by A. P. Sloan, Jr., board chairman of GM, who said that manufacturers' costs would be up about 10 per cent and the added cost to the consumer, after including the bigger excise tax, would be not more than 15 per cent above 1941 models. Other forecasts have been for an even greater price increase. Price announcements will await the definite decision on 1942 model curtailment, as mass production costs are directly related to output. The companies also have been holding conferences with OPACS relative to a ceiling on 1942 automobile prices.

Production in the U. S. and Canada for the first six months of 1941 totaled 3,148,694 vehicles, according to the Department of Commerce, an increase of 24 per cent over output for the first half of 1940. June output of 546,274 units was the greatest for any month since April, 1937, and 68 per cent above June, 1940. July's output of 482,391 vehicles, as estimated by the AMA, was 96 per cent greater than the same month of 1940. U. S. production in the 1941 model year is estimated at 5,295,000 units.

Retail passenger car sales in the U. S. climbed 38 per cent in the first half of 1941, totaling 2,548,209 units, according to the AMA. Commercial vehicle sales were up 48 per cent in the same period, reaching 468,890 units. New passenger car registrations for the six-month period exceeded 1929, according to R. L. Polk & Co., totaling 2,467,281 units compared to 2,155,357 in the same period of 1929. The 1941 figure marked a 36 per cent gain over the like period of 1940. New truck registrations totaled 390,114 units for the half year compared to the previous high of 342,077 set in the first half of 1937. Truck registrations gained 34 per cent over 1940.

Brisk retail sales accounted for the fact that only 155,770 new passenger cars were estimated in dealer stocks as of July 1, less than two weeks' supply at the 1941 selling pace. July retail sales also continued strong, showing an advance of 22 per cent for the first 14 days of the month, according to new passenger car registrations from 94 principal cities by R. L. Polk.

Production for the first half of August was estimated at 74,500 units as most plants reached the changeover period, indicating that the 1940 August total of 89,866 units is sure to be surpassed, even with output dropping in the last half of the month.

[1] 1923 average = 100; [2] Prepared by Administrative and Research Corp. of New York. 1926 = 100; [3] Estimated at the Detroit office of AUTOMOTIVE INDUSTRIES.

Automobile Industry Waits While OPM-OPACS Mark Time

Vacillating Government Policy and Materials Situation Creates Uncertainty; Consider Rationing to Consumers

While OPM and OPACS are marking time on the controversial question of curtailing automobile production, OPACS Administrator Leon Henderson explained to a Congressional committee that his proposal to slash production by 50 per cent is dictated by shortages of materials, particularly steel and copper. Testifying in favor of the pending Price Control Bill, he said:

"I have no doubt that the automobile industry will repair all of the gap and need even more than 50 per cent of its productive facilities to fill defense orders."

After the representatives of the automobile industry met with both OPM and OPACS officials in Washington on July 29, when a slash below 600,000 passenger cars in August, September and October was taken to be a certainty, there were indications that the controversy was headed for a showdown and that the White House would act promptly on the question of jurisdiction. However, two factors reputedly intervened to delay such action. President Roosevelt left on his cruise through northern waters and the UAW-CIO union launched its convention in Buffalo. In some quarters both OPM and OPACS officials were represented as being reluctant to have the automobile production controversy break wide open while the convention was in session.

Meanwhile, OPM's Automobile Commodity Division headed by James S. Adams conferred with the industry's technical committee on the problems of substitution, conservation of materials, and shifting to defense production, while industry representatives sought from OPM and OPACS further information on the OPM action in subjecting all steel to full priority control.

It was under OPACS civilian allocation authority that Mr. Henderson first suggested the tentative 50 per cent curtailment in automobile production and plunged the agency into its jurisdictional dispute with OPM. Up to that time, OPM had been negotiating with the automobile industry on the subject. Before OPACS issued its tentative order, it is understood that it held virtually no conferences with industry representatives, and the industry to this day apparently remains in the dark as to whether the curtailment will be carried out on a raw materials or unit basis W. S. Knudsen, director of OPM, recently stated the problem directly and simply when he said, "Auto production isn't going to be decided by what the OPM or OPACS think about it. Materials are the deciding factor."

In sharp contrast to the reputed failure of OPACS to call on industry representatives before issuing its tentative curtailment order, Henderson aides are now reported to be studying a proposal by which they could ration automobiles to consumers. In this connection it already has approached the automobile industry seeking guidance in this complex problem.

UAW-CIO Membership Has Rapid Growth

Paid-up membership in the UAW-CIO totals 528,213 members, according to the annual report of President Roy J. Thomas, submitted to the annual convention of the union early in August at Buffalo. This marks a 300 per cent increase in 18 months, as the membership numbered 187,482 in December, 1939. UAW-CIO contracts cover 703,760 workers in 982 plants compared with 398,377 workers in 647 plants a year ago. During the 12 months ending July 1, 1941, the UAW-CIO won 116 out of 177 NLRB elections in automobile, parts and aircraft plants, covering 147,443 workers. The AFL won 24 polls covering 4470 workers.

Income for the fiscal years ending April 30 totaled $1,921,149, an 87 per cent increase over the previous 12-month period. Expenditures were $1,543,189. Of the 1940-41 expenditures. 43 per cent went for organization work. 23 per cent for administration, $138,914. or 9 per cent, for the Ford organizing drive, $185,923 for publications and $53,393 for the aircraft organizing drive.

At the annual convention, the name of the union was changed to International Union, United Automobile, Aircraft & Agricultural Implement Workers of America, but the designation UAW-CIO will be retained for convenience. The convention ordered an organizing drive among the automobile industry's 70,000 office employes. a move which might bring a jurisdictional conflict with the Office and

(*Turn to page* 45, *please*)

7 Cities Consider Shows

At a recent meeting of Automotive Trade Association Managers in Chicago, show managers present approved a resolution urging manufacturers to cooperate with cities desiring to hold shows. A poll revealed that tentative dates had been set for shows in Los Angeles (Oct. 11 to 19); Chicago (Oct. 12 to 19); and San Francisco (Oct. 17 to 26). Other shows are contemplated in Pittsburgh, Baltimore, St. Louis, and possibly Detroit.

Acme

Britain's Vengeance

Of the same type as Germany's Stuka dive bomber, this 1600-hp. Vultee Vengeance is being produced for Britain's RAF. This is the first picture of the warplane, which has a wing spread of 48 ft., length of 37 ft. and seats two men. Its maximum speed in a vertical dive is said to be slightly over 300 m.p.h. The bomb load of 1700 lb. is carried internally.

Packard in Production on Rolls-Royce Merlin Engine

Promises 500 a Month Soon; Continental, Ford and Chrysler Also Have Liquid Cooled Aircraft Engines in Development

Production of Rolls-Royce Merlin XX aircraft engines began at the Packard Motor Car Co. early in August. Under the contract, two-thirds of the output will go to power British fighter planes like the Hurricane and Spitfire, while one-third will go to the U. S. Army Air Corps, which has made the necessary alterations in the Curtiss P-40 for installation of the Merlin engine.

At the ceremonies dedicating the new aircraft engine production facilities, President Max M. Gilman, of Packard, acknowledged the assistance of Ford, Pratt & Whitney, Curtiss-Wright and the Allison Division of GM in making available data on the Rolls-Royce engine which they had collected. W. S. Knudsen, director of OPM, said that 2200 of the 3000 machine tools needed for peak production at Packard had been installed. He said the company had promised an output of 500 engines in the next four or five months and would reach a peak rate of 40 engines per day by December. Initial order is for 9000 engines.

Sir Henry Self, head of the British Air Commission in the U. S., said the Rolls-Royce Merlin XX had its genesis in 1931 when its prototype was used to power the British seaplane that won the Schneider Cup, emblematic of world air speed supremacy. The airframe design of the same plane since has been developed into the Spitfire fighter. The horsepower of the Rolls-Royce Merlin was unrevealed but it is a 12-cylinder liquid-cooled engine weighing 1640 lb.

The 40 sound-proof test sheds at Packard require 596 gals. of gasoline per hr. for test runs, which consume 12½ hr. for each engine. Daily gasoline consumption when capacity production is reached will total 74,800 gals.

Continental Gets "Go Ahead"

Continental Aviation & Engineering Corp., Detroit, has received a government letter of intent for $5,000,000 covering machines and machine tools to manufacture its new high output aircraft engine. This is understood to be a 12-cylinder liquid-cooled engine of upwards of 1500 hp. to power fighter planes.

Ford's new liquid-cooled 12-cylinder aircraft engine had its initial block test early in August. A maximum output of 1800 hp. at 3600 r.p.m. for takeoff is the goal of Ford engineers. If tests are successful, the engine will be shipped to Wright Field for testing by the Army Air Corps.

Chrysler Corp., which also has a liquid-cooled aircraft engine in the experimental stage, has received a Defense Plant Corp. award of $403,022 for machinery and equipment to use in the development and servicing of aircraft engines.

GM Tabulates Defense Deliveries

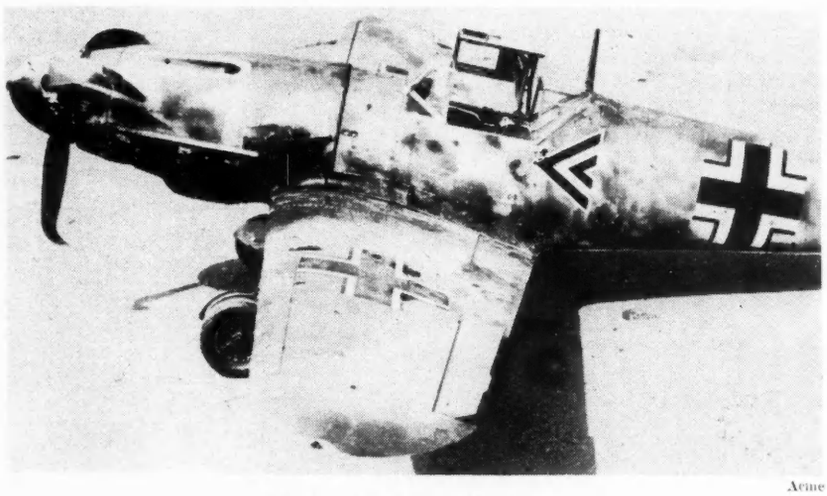
General Motors delivered $209,500,000 worth of defense materials up to June 30, according to announcement of Chairman A. P. Sloan, Jr. Of this amount, $75,200,000 was delivered in the second quarter of 1941. Broken down by products, total deliveries included $45,400,000 in military trucks; $48,400,000 in diesel engines for military and naval use, $60,900,000 in aircraft engines and parts, $4,800,000 in guns, shells and related items, and $45,100,000 from Canadian plants, chiefly trucks.

Defense products constituted 10.7 per cent of second quarter sales volume and this percentage is expected to grow increasingly greater. Thirty-six thousand employes, or 14.4 per cent of GM productive workers, are now engaged in defense activities. Total GM defense orders are estimated at $1,200,000,000.

Fisher Body Division received a signal award Aug. 7 when Plant No. 23, die and machine units, in Detroit was presented with the Navy "E" (for excellence) in supplying 2400-lb., 5-in. gun housings 2½ months ahead of schedule. Admiral Watt T. Cluverius made the award to E. F. Fisher, general manager of Fisher Body. Thirteen similar awards were made to other plants around the country but Fisher Body was the only one to receive it so far in the automotive industry.

Plymouth Division of Chrysler has adapted 400 of its automotive machine tools, mostly general purpose equipment such as milling machines, for the manufacture of parts for the Bofors

(*Turn to page 52, please*)



Acme

Late German Fighter

This German single-seat fighter plane, captured almost intact by the British, is a Messerschmitt 109F, the latest in Reich warplanes. Obviously intended for higher speed and better maneuverability at greater heights, this new version is equipped with a heavily supercharged 1375 hp. Mercedes-Benz engine. The top speed is given as 380 m.p.h. at 21,000 ft. and the ceiling 38,000 ft.

Its span is 35¼ ft. and the wing area about 185 sq. ft., the area being increased by rounding out the wing tips to replace square type used on the earlier planes. There is no radio aerial mast, but instead an aerial wire extends forward from the tip of the fin to the fuselage. Half of the tail wheel is exposed when it is retracted.

The armament consists of a 20 mm. cannon, which fires through the hollow propeller hub, and two .30 cal. machine guns, one mounted at each side of the engine cowling. Armor protection is greater, particularly behind the pilot's seat where the plate thickness is 18 mm.

CALENDAR

Conventions and Meetings

Natl. Petroleum Assoc., Atlantic City, Sept. 17-19

Society of Automotive Engineers, National Tractor Meeting, Milwaukee, Sept. 25-26

Natl. Lubricating Grease Inst., Chicago, Sept. 29-30

Natl. Safety Council, Chicago.....Oct. 6-10

Exposition of Power & Mechanical Engineering, Chicago .....Oct. 6-11

Amer. Society of Tool Engineers, Toronto, Canada .....Oct. 16-18

National Metal Congress and Exposition: Cooperating societies—American Society for Metals, Wire Association, American Welding Society, Institute of Metals and Iron and Steel Divisions of American Institute of Mining and Metallurgical Engineers, Philadelphia.....Oct. 20-24

SAE Natl. Fuels & Lubricants Mtg., Tulsa, Okla. .....Oct. 23-24

Society of Automotive Engineers, Aircraft Production Meeting, Los Angeles ..... Oct. 30-Nov. 1

SAE West Coast Transportation Mtg., San Francisco .....Nov. 5-6

SAE Natl. Transportation & Maintenance Mtg., Cleveland.....Nov. 13-14

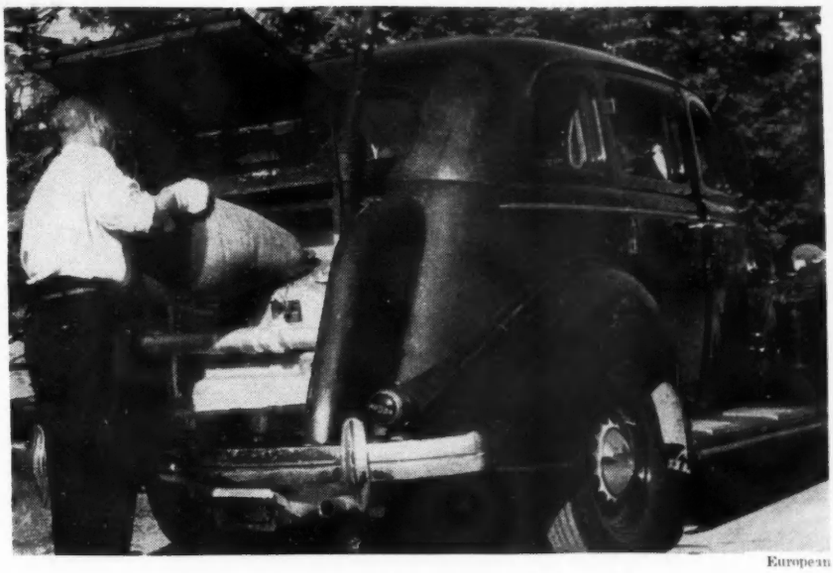
National Assoc. of Manufacturers, New York City .....Dec. 3-5

Anti-Aircraft Detector At Ft. Monmouth, N. J.

The War Department has awarded a contract to the Ehret-Day Co. of Asbury Park, N. J., for the construction of the initial portion of an anti-aircraft detection and photographic laboratory at Ft. Monmouth, N. J.

Electric anti-aircraft detection instruments are a closely guarded military secret, but the Signal Corps has disclosed that these delicate apparatus utilize radio beams in detecting approaching hostile aircraft, revealing not only the presence of enemy bombers, but their distance, direction and altitude.

Total cost of the contract, which was approved by the Office of Production Management, is estimated at approximately $1,270,000, of which construction amounting to about $735,000 will begin at once. Six temporary buildings, together with necessary utilities and appurtenances, will be constructed first.



European

Charcoal Rations for Tokio Taxi

What the Japanese are doing with their gasoline supplies is not revealed, but this Tokio taxi driver is refueling his cab with charcoal. This picture is one of the few to reach this country from Japan, where a tight censorship now exists.

Army Tests New Lockheed Transports

Two transport airplanes manufactured by the Lockheed Aircraft Corp., Burbank, Cal., are undergoing tests by the Army Air Corps.

The transports—designated as C-56 and C-57—are all-metal, midwing, cantilever monoplanes with twin tail assemblies and conventional retractable landing gears. Each airplane has a wing span of 65 ft. 6 in.; is 49 ft. 10 in. long and has a gross weight of 17,500 lb. Each carries a crew of two pilots. The commercial counterpart of both planes is the Lockheed "18 Lodestar."

The C-56 is powered with two 1100-hp. 9-cylinder Wright engines. Interior fittings are of the executive type, which include tables and other facilities for administrative use when in flight.

The C-57 is powered with two Pratt & Whitney 1200 hp. 14-cylinder engines. It is fitted with 14 standard airline chairs for the transport of personnel.

GE to Make Turbo-Superchargers at Ft. Wayne

Plans for the costruction of a $20,000,000 factory at Fort Wayne, Ind., for the manufacture of turbosuperchargers for airplanes have been announced by General Electric Co. Construction is expected to start within two months. The building will be one story high, 800 ft. long and 500 ft. wide.

At present the company is manufacturing this device for high-altitude fighting planes and bombers at Lynn, Mass., and a $5,000,000 factory for similar manufacture is nearing completion at Everett, Mass. Fort Wayne was selected as the site for the new plant in line with War Department policy to locate new factories for defense production far inland.

Walter R. Bamford

Walter R. Bamford, service director of the Dodge Division, Chrysler Corp., died suddenly Aug. 2 at his summer home at Brighton, Mich. He was 56 years old. Bamford had been with Dodge since 1925. Previously, he was associated with Oldsmobile, Chalmers, Hupmobile, Maxwell and Fulton Truck.

New Passenger Car Registrations

	JUNE 1941	May 1941	JUNE 1940	SIX MONTHS 1941	SIX MONTHS 1940	Per Cent Change, 6 Months, 1941 over 1940	Per Cent of Total Six Months 1941	Per Cent of Total Six Months 1940	NINE MONTHS MODEL YEAR 1941	NINE MONTHS MODEL YEAR 1940	NINE MONTHS MODEL YEAR Per Cent Change
Chevrolet	103,324	121,411	78,951	596,477	457,575	+ 30.3	24.22	25.13	828,778	667,141	+ 24.2
Ford	71,586	76,854	50,492	382,542	296,032	+ 29.0	15.53	16.32	527,327	440,403	+ 19.7
Plymouth	54,601	66,290	45,635	304,772	240,340	+ 27.0	12.37	13.25	421,385	314,915	+ 33.8
Buick	37,569	42,311	24,119	209,915	144,427	+ 45.4	8.52	7.93	298,928	222,541	+ 34.3
Pontiac	33,168	39,889	22,341	194,944	119,564	+ 63.2	7.91	6.59	266,519	178,580	+ 49.2
Oldsmobile	27,332	33,551	18,223	159,488	103,474	+ 54.0	6.47	5.71	219,745	156,996	+ 39.9
Dodge	24,566	29,948	19,413	136,884	113,027	+ 21.0	5.56	6.24	180,542	147,166	+ 22.7
Chrysler	17,531	21,607	9,477	95,103	54,168	+ 75.5	3.86	2.98	122,705	70,237	+ 74.7
Studebaker	13,968	14,315	10,172	67,005	52,881	+ 27.0	2.72	2.91	93,923	80,055	+ 17.3
De Soto	11,254	13,611	6,910	57,746	37,806	+ 53.0	2.34	2.09	75,665	49,674	+ 52.3
Nash	10,228	11,265	4,719	54,033	29,051	+ 86.2	2.19	1.62	67,158	43,721	+ 53.6
Mercury	10,045	10,807	7,405	52,718	44,457	+ 19.0	2.15	2.45	72,314	66,475	+ 8.8
Hudson	8,232	9,963	7,361	45,831	41,351	+ 10.8	1.86	2.28	66,225	65,521	+ 1.1
Cadillac	7,105	8,110	2,933	39,226	18,001	+118.0	1.59	.99	53,105	29,267	+ 81.4
Packard	7,734	8,650	6,352	39,190	37,448	+ 4.9	1.59	2.08	57,734	59,162	- 2.4
Willys-Americar	2,637	3,074	1,827	13,250	11,207	+ 18.2	.55	.63	18,096	17,115	+ 5.7
Lincoln	2,292	2,426	1,522	11,783	10,903	+ 8.0	.49	.61	17,246	16,755	+ 2.9
Graham	40	54	218	461	624	- 26.0	.02	.04	992	937	+ 5.9
Crosley	108	68	16	327	244	+ 34.0	.01	.01	438	379	+ 15.6
Bantam		6	57	81	512	- 84.2		.03	180	744	- 75.8
Miscellaneous	150	268	472	1,287	1,722	- 25.4	.05	.09	2,433	2,329	+ 4.5
Total	443,470	514,478	318,615	2,463,063	1,814,814	+ 36.0	100.00	100.00	3,391,438	2,630,113	+ 28.9
Chrysler Corp.	107,952	131,456	81,435	594,505	415,341	+ 33.6	24.14	24.54	800,297	581,992	+ 37.5
Ford Motors	83,923	90,087	59,419	447,043	351,392	+ 27.2	18.15	19.36	616,887	523,633	+ 17.8
General Motors Corp.	208,498	245,272	146,567	1,200,051	843,041	+ 42.3	48.72	46.45	1,667,075	1,254,525	+ 32.9
All Others	43,097	47,663	31,194	221,465	175,040	+ 26.2	8.99	9.65	307,179	269,963	+ 13.8

100% Steel Priority Brings Little Change

Merely Gives Official Status to Unwritten Rule That Has Been Observed by Most Producers Throughout the Emergency

By W. C. Hirsch

Establishment of 100 per cent priority control over steel mill output by the Office of Production Management has not injected any new element into the situation, being merely official notice to both steel producers and consumers that defense needs must be met ahead of non-defense orders. The rule had so far been unwritten, but had been well understood in the steel market ever since the beginning of the emergency.

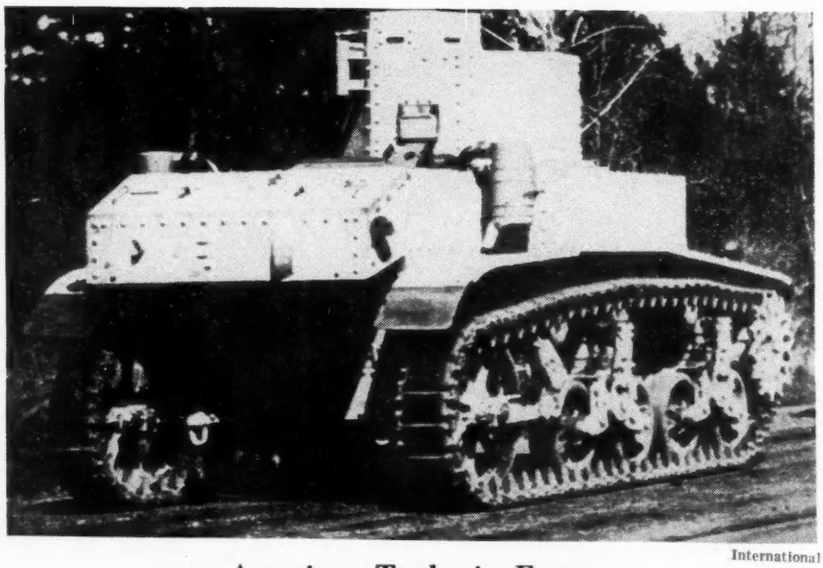
A few producers are said to have refused defense orders, pointing to their well-filled order books and the heavy liability they might incur for delays in deliveries. But now the OPM priority control order exempts steel producers from all liability for any default resulting from compliance with the Government's regulations and, therefore, clarifies the situation. Moreover, the OPM order relieves steel producers from much of the burden of having to analyze orders as to the reasonableness of the tonnages called for. Such investigation is perhaps more necessary in the case of steel ordered for non-military purposes, but allocation of all steel, whether for civilian or defense purposes, is expected to come under Government supervision from now on. The responsibility for preventing diversion to non-essential uses, while more important needs go unfilled or are deferred, will rest on the shoulders of Government officials rather than on those of steel company executives.

A steel deficit of 11,000,000 tons for the current year was forecast by OPM officials at the time they issued the priority order, but they emphasized that there was an ample supply of steel for defense needs, while consumption for civilian purposes would have to be trimmed. In this connection it is well to point out that estimates of civilian needs are necessarily based on the statistical record of the last few years; it is not impossible, however, that there will be a sharp curtailment in the steel requirements of many industries as the result of changed conditions, lack of an adequate supply of fabricating labor in some cases and shrinkage of outlets in others. Not a few steel market observers feel that too little weight has been given so far to this probable contraction in some civilian requirements, and that this is likely to ease the strain much more than would appear from forecasts based on statistics under relatively normal conditions.

Paucity in the supply of iron and steel scrap continues to hamper production more than any other factor. Scrap iron dealers say that direct buying of scrap by steel mills impairs their turnover to the point where they can no longer operate profitably, but mills that face shutdowns because of lack of scrap are not standing on any ceremony and pick up supplies wherever they can. Conditions during World War No. 1 were at times similar. A movement to further direct scrap sales to mills got under way then, and the practice of returning non-ferrous scrap to the manufacturers of the metal products, from which it was derived, has grown steadily since then. It is quite true that in the case of ferrous scrap, many grades call for considerable preparation for service, but under the pressure of their needs, some mills appear to have found means of doing the job satisfactorily.

The heretofore prevailing dual price of copper, 12 cents a pound for the metal marketed by the large producers and 12½ cents for that sold by custom smelters, has now been abrogated. The price ceiling for all electrolytic copper, regardless of its origin, is now 12 cents. No definite decision appears to have been reached so far regarding the paying of subsidies to high cost producers, but their output is also to be marketed at 12 cents.

In the tin market some sort of an announcement regarding maximum prices is looked for at an early date. The market for spot Straits rose to 55 cents a pound when things in the Far East looked blackest, but since then prices have eased off slightly, chiefly because early establishment of a price ceiling was expected.



International

American Tanks in Egypt

American-built M-3 tanks of this design have been used by the British on the battlefront in Egypt. This picture shows one of a column clanking down a road somewhere in England.

Fisher Gets Navy Award for Excellence

The United States Navy's "E" award for excellence has been awarded to the Fisher Body Die and Machine Unit in Detroit. The "E" pennant—the highest service award in the Navy—was presented to the Fisher plant for its excellence and ahead-of-schedule production of naval ordnance.

Boosts Valve Steel Output

To help meet a heavy increase in the demand for airplane valve steel, the Allegheny Ludlum Steel Corp., Pittsburgh, is undertaking an expansion of its Watervliet, N. Y., plant.

Pilots Double in Year

On July 1 there were more than twice as many civil airplane pilots in the United States as there were a year ago, according to the Civil Aeronautics Administration. The current figure is 82,277 compared with 41,006 a year ago.

ADVERTISING

Elsewhere in this issue is reproduced a two-page advertisement prepared by the *Saturday Evening Post* as a tribute to automotive service men. Entitled "Nobody with Greasy Hands Gets Rich," the copy is designed to keep the public's faith in the service man. Enlarged reprints of the ad, which will appear in the Sept. 20 issue of the *Post*, are being offered free to service men for window or wall display.

Willys Introduces Americar for 1942

Relatively few changes have been made in the Americar of Willys-Overland Motors, Inc., for 1942. In general appearance the car remains very much the same. The chassis with a four-cylinder, 63-hp. engine will be equipped with three passenger-car and three commercial bodies, the former including a sedan, a coupe, and a deluxe station wagon, while the commercial models are a ½-ton pick-up truck, a panel delivery truck, and a taxicab.

Alloy cast iron pistons have been substituted for the aluminum-alloy pistons formerly used. The new pistons, of molybdenum iron, are thin-walled; they are ribbed to increase their stiffness and their heat-dissipating capacity, and they are tin-plated to help in the wearing-in processs. Automatic heat control is now provided on the carburetor.

The only change in external appearance is due to the provision of a chrome strip dividing the radiator grille vertically, which forms an extension of a similar strip along the center of the hood. All models come regularly with running boards, but the DeLuxe and Speedway series will be furnished without running boards on request. The upholstery is in two-tone dark-brown and beige combinations. The dark-brown material is pincord, while the beige is Canda cloth. Door panels also carry this two-tone combination, in a diagonal pattern. Considerable plastic material, in a deep buff shade, is used in the instrument panel, while the door of the glove compartment is walnut-grained, as are the windshield garnish moldings and the decorative panel inserts on the doors.

W. E. Blanchard Resigns

Walter E. Blanchard, general manager of National Automobile Dealers Association, resigned from that position August 9. Irving H. Post, assistant manager, who has been a member of the NADA staff for nine years, has been appointed acting manager.

75 New Airports

During the first half of this year 75 new airports were approved by the Civil Aeronautics Administration as compared with 51 added during 1940. The total number of airports approved by CAA throughout U. S. is 2277.

Canadian Propeller Plant

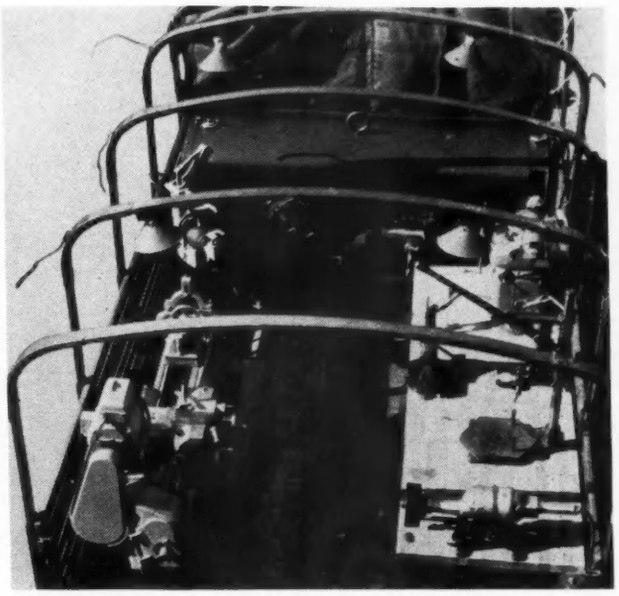
Canada's Department of Munitions and Supply has awarded a $349,000 contract for the construction of a new propeller plant at Longue Pointe, Que. The permanent-type building is expected to be completed during October.

John C. Haartz

John C. Haartz, president of Haartz Auto Fabric Co., Watertown, Mass., died August 1, age 60 years.

Army's Mobile Shop Truck

To facilitate repair service, the U. S. Army is being equipped with shop trucks like this one. Each of these mobile units contains a lathe, brake reliner, power generator and arc welder, valve refacer, vise, drill stand, and grinder.



Courtesy Hobart Brothers Co.

UAW-CIO Membership

(*Continued from page* 41)

Professional Workers Union (CIO). Thomas told the convention that the UAW considers aviation plants under AFL locals as "unorganized," and that a drive will be pushed in such plants. The convention refused to seat 10 delegates from the Allis-Chalmers local in Milwaukee by a vote of 1738 to 1244. This local, which participated in a 75-day strike last winter that held up national defense production, has been accused of Communist leadership under Harold Christoffel, its president. A strike vote taken by the local during the strike also is under investigation.

A feature of the convention was a display advocating the purchase of Ford Motor Co. products, with a Ford car having an advanced copy of the UAW-CIO label fastened to the instrument panel. Last year the emphasis was on non-union Ford products.

Four more General Motors plants have voted for the UAW-CIO in NLRB election, bringing the total to 83 GM plants in which that union has bargaining rights. The new plants are Chevrolet Motor & Axle plant at N. Tonawanda, N. Y., which is being converted for aircraft production; Olds Forge plant at Lansing; the Norwood (Ohio) Fisher plant, and the Norwood Chevrolet plant.

Average weekly earnings in the Michigan automobile industry during June were $50.34, according to the monthly report of the Michigan Dept. of Labor & Industry, setting a new high. Factory employment in Wayne County (Detroit) as of July 31 totaled 327,000 hourly rated workers, a decrease of 66,000 since July 15 but 109,000 more than on July 31, 1940.

M. J. Tennes, Sr.

M. J. Tennes, Sr., chairman of the Shafer Bearing Corp., Chicago, died August 7.

New Truck Registrations*

	June 1941	May 1941	June 1940	SIX MONTHS 1941	SIX MONTHS 1940	Per Cent Change, 6 Months 1941 over 1940	Per Cent of Total Six Months 1941	Per Cent of Total Six Months 1940
Chevrolet	21,722	22,332	13,835	119,183	96,721	+ 23.2	33.67	33.83
Ford	17,325	17,290	11,599	102,394	80,928	+ 26.8	28.93	28.30
International	8,580	9,023	6,239	49,673	37,339	+ 33.0	14.04	13.06
Dodge	5,951	6,012	4,374	31,992	29,511	+ 8.5	9.04	10.32
G. M. C.	3,800	4,224	2,953	22,747	19,288	+ 17.8	6.42	6.75
Plymouth	904	1,066	902	5,647	5,470	+ 3.0	1.59	1.91
Mack	851	905	560	4,686	3,500	+ 33.8	1.32	1.22
White	835	811	558	4,686	3,252	+ 44.0	1.32	1.14
Diamond T	507	561	533	3,235	3,130	+ 3.2	.91	1.09
Studebaker	456	434	103	2,210	688	+221.0	.62	.24
Autocar	237	228	126	1,258	805	+ 56.1	.36	.28
Divco	228	213	107	1,174	898	+ 30.7	.33	.31
Brockway	179	244	121	1,110	698	+ 59.0	.31	.24
Willys-Americar	214	252	188	984	1,223	− 19.5	.28	.43
Federal	114	156	116	775	845	− 8.3	.22	.30
Reo	135	157	20	753	54	+1294.4	.21	.02
Hudson	86	84	67	477	442	+ 8.0	.13	.15
Sterling	32	43	30	225	167	+ 34.6	.06	.06
F. W. D.	12	16	11	121	138	− 12.3	.03	.05
Bantam	2	3	24	31	258	− 88.1	.01	.09
Miscellaneous	95	125	67	684	589	+ 16.0	.20	.21
Total	62,265	64,177	42,533	354,045	285,944	+ 24.0	100.00	100.00

* Federal Deliveries are no longer included with these data for 1941 or 1940.

Business in Brief

***Written by the Guaranty Trust Co., New York, Exclusively for* AUTOMOTIVE INDUSTRIES**

General business activity fluctuates narrowly around new peak levels. The index of *The Journal of Commerce*, without adjustment for seasonal variation, for the week ended August 2 stands provisionally at 123.5 per cent of the 1927-29 average, two fractional points below the final figure in July, as against 103.9 a year ago. The seasonally adjusted index of The New York *Times* for the week ended July 26 rose to an all-time peak, 133.3 per cent of the estimated normal, as against 131.5 for the preceding week.

Department store sales during the week ended Aug. 2, according to the Federal Reserve compilation, exceeded by 27 per cent the corresponding total last year, the same percentage gain as that shown for the week before.

Contracts awarded for heavy construction during the week ended Aug. 7, according to *Engineering News-Record*, totaled $233,581,000, about 35 per cent more than the figure for the preceding week and three times the corresponding amount last year.

The movement of railway freight during the week ended Aug. 2 registered a slightly more than normal decline. Loadings totaled 883,065 cars, 1.6 per cent fewer than in the week before but 23.0 per cent above the comparable number a year ago.

Electric power production in the same period rose to an all-time peak, 16.8 per cent greater than the output a year ago, as against a similar gain of 15.3 per cent a week earlier.

The number of business failures during the final week of July dropped sharply to 190, as compared with 253 in the preceding week and 271 a year ago, according to the Dun & Bradstreet report.

Crude oil production in the week ended Aug. 2 averaged 3,695,250 barrels daily, 174,700 barrels less than the average a week earlier and 151,850 barrels below the currently required output as computed by the Bureau of Mines.

Average daily production of bituminous coal for the week ended July 26 was 1,775,000 tons, as against 1,767,000 tons in the preceding week and 1,355,000 a year ago.

Cotton mill activity in the same period advanced contra-seasonally. The New York *Times* adjusted index rose to 188.6 per cent of the estimated normal, as compared with 180.8 a week earlier and 119.3 a year ago.

Professor Fisher's index of wholesale commodity prices, registering a new five-year peak, stands for the week ended Aug. 1 at 96.5 per cent of the 1926 average, as against 95.9 for the preceding week.

Member bank reserve balances declined $146 millions during the week ended Aug. 6, and estimated excess reserves fell $140 millions to just over $5 billions. Business loans of reporting members increased $36 millions in the preceding week to a total $1606 millions greater than the corresponding amount last year.

Estimated Dealer Stocks of New Passenger Cars*

1941	January	February	March	April	May	June
Production—U. S. Domestic Market †	401,774	385,706	398,773	363,867	408,885	408,824
Retail Sales—U. S. ‡	303,564	345,455	449,551	483,116	524,365	442,158
Change in Inventory	+98,210	+40,251	−50,778	−119,249	−115,480	−33,334
Inventory, First of Month, 1941	336,550	434,760	475,011	424,233	304,984	189,504
Inventory, First of Month, 1940	215,856	325,102	412,800	416,281	414,672	399,592

*—Dealer stocks as of July 1 were 156,170 as compared with 325,670 in 1940.
†—U. S. Census Bureau. ‡—Automobile Manufacturers Association.

Acme

Another U. S. Dive Bomber

Equipped with greater fire power and more streamlined for higher speeds, this newly-developed Curtiss Hawk, an improved version of the Curtiss Tomahawk fighter, P-40D combination pursuit, dive bomber, is in production at Curtiss-Wright's Buffalo plant for the Army Air Force. It is said to be powered by a new liquid cooled engine, but performance and armament data are withheld by the War Dept.

Change in Nebraska Tractor Test Rules

In the official tests on farm tractors made at the University of Nebraska, two additional drawbar tests are now made on tractors equipped with rubber tires. The first of these, Test J, is made in the rated gear, using the operating carburetor setting, the principal object being to show the effect of removal of added weight on the performance of the tractor. In Test J, the wheel and tire equipment used is the same as in Tests F, G and H except that all added weight, either liquid, cast iron or any other form, is removed. Test J may be compared directly with the rated-gear run in Test G.

The purpose of Test K, the second of the two additional tests, is to show the performance of the tractor in rated gear with operating carburetor setting and equipped with wheels, tires and weight as recommended in the manufacturers' published specifications. If the manufacturer does not make a specific recommendation, then the tires used are the smallest size and ply listed in published specifications or applications for test, as being available for use on the model of tractor being tested. Where there is no contrary recommendation, the lightest wheels are used, and no additional weight, either liquid or solid, is permitted.

Parts Makers Named To Advisory Committee

Completing the recently established 19-man Automotive Industry Defense Advisory Committee, the following eight representatives of the parts industry have been appointed by the OPM.:

William P. Brown, Briggs Mfg. Co., Detroit; Willard F. Rockwell, Timken-Detroit Axle Co., Detroit; C. C. Carlton, Motor Wheel Corp., Lansing; Charles S. Davis, Borg-Warner Corp., Chicago; J. D. Eby, Wagner Electric Co., St. Louis; C. E. Hamilton, Automotive Gear Works, Inc., Richmond, Ind.; H. R. Kerans, K-D Lamp Co., Cincinnati, and Burke Patterson, Thompson Products, Inc., Cleveland.

The other 11 members represent the passenger car and trucking manufacturing industry.

No More White Sidewalls

The manufacture of white sidewall tires has been prohibited by the OPM. The order takes effect at midnight, Aug. 23, 1941. It is estimated that cessation of white sidewall tire manufacture will save more than 6000 tons of crude rubber a year, since each white-wall tire consumes approximately two pounds more crude rubber per tire than the production of ordinary black tires. The order will also save some zinc, which, in oxide form, is used in the coloring of white sidewalls.

MEN . . . . . .

Dr. Vannevar Bush has resigned as chairman of the National Advisory Committee for Aeronautics and **Dr. Jerome C. Hunsaker** has been elected as his successor. Dr. Bush, who is president of the Carnegie Institution of Washington, resigned because of his recent appointment by the President as director of the newly created Office of Scientific Research and Development. **Dr. Robert E. Doherty** has also resigned as a member of the committee and **Dr. William F. Durand** has been appointed to succeed him.

Mark Veckman recently was elected assistant treasurer of Republic Aviation Corp., Farmingdale, N. Y.

James Dykstra has been named assistant chief engineer of Oldsmobile in charge of chassis and body design, succeeding **Maurice A. Thorne,** who has been transferred to Detroit to become a member of the staff of C. L. McCuen, General Motors vice president in charge of defense engineering.

J. W. Blackmore, formerly with the Kankakee, Ill., branch of International Harvester Co., has been appointed manager of the Milwaukee, Wis., motor truck branch, succeeding **L. W. Pierson,** who has been made manager of the central district.

F. G. Gardner has been promoted to acting chief engineer of the Kellogg Switchboard & Supply Co.; **George R. Eaton,** vice president in charge of engineering, is taking a leave of absence because of ill health.

Sealed Power Corp. has added two new directors, **A. W. Lines,** president of Accuralite Co. division, and **Lester Matthews,** credit manager and assistant treasurer. **William R. Tyson** has been appointed personnel manager.

C. B. Voldrich has been named a research engineer on the technical staff of Battelle Memorial Institute, Columbus, Ohio, where he will assist in the institute's program of welding research.

Edward M. Kimball has been appointed New England representative for McKenna Metals Co., Latrobe, Pa.

Labert St. Clair, former Associated Press writer, has been named as executive assistant of the National Automobile Dealer's Association. He is attached to the Washington office.

Howard R. Munshaw has been appointed head of the coach division of Reo Motors, Inc. He formerly was associated with Kalamazoo Coaches and with the motor coach division of Gar Wood Industries, Inc.

Lincoln R. Scafe, formerly general manager of the Fisher Body Cleveland Div., has been appointed general manager of the Glenn L. Martin-Nebraska Co. in Omaha.

Brig.-Gen. Frank T. Hines and **Lindsey Hopkins, Jr.,** have been named to vacancies on the board of directors of Sperry Corp.

Clarence E. Skinner has been named manager of the new Washington office of Automotive Parts & Equipment Manufacturers, Inc. He was general manager of APEM until early in 1940, when he left to join the labor relations staff of General Motors Corp.

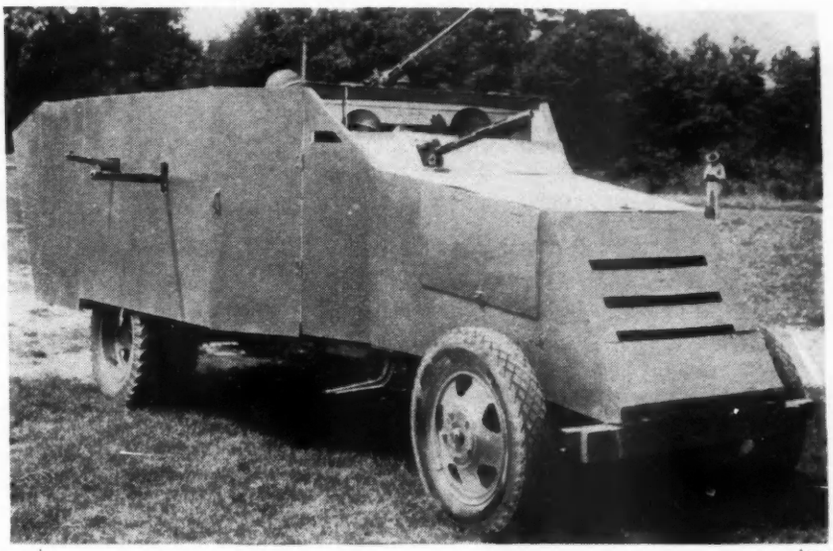
J. E. Nelson, H. A. Giddney, and **Alan M. Scaife** were elected members of the directorate of Gulf Oil Corp.

W. B. Marshall has been promoted to sales manager of the Conveying and Engineering Products Division of the Chain Belt Co., Milwaukee. **B. E. Sivyer** has been made assistant sales manager of the Chain Belt and Transmission Division; **S. Y. Warner** is replacing Sivyer as branch manager at San Francisco.

Alex Taub, American designer and development engineer for Vauxhall, Ltd., in England, has been named chief technical consultant of OPM's automotive branch.

T. Spencer Shore, vice president and treasurer of the General Tire & Rubber Co., Akron, has been named assistant chief of OPM's bureau of clearance, under the OPM advisory committee set-up. He succeeds **Robert H. Webb-Peploe,** resigned.

Cyrus McCormick, former International Harvester Co. executive, has been named price executive of the automobile and truck section of OPACS.



Acme

Anti-Tank Wagon

Designed to carry a 37-mm. anti-tank gun inside at the rear instead of "in tow," this light, but well-armed truck is said to gain added mobility for anti-tank units. In addition to the 37-mm. gun, which may be fired from truck or rolled down a ramp onto the ground, the unit carries four machine guns. It has been tested by the U. S. Army.

New Lubricator Line

The Cincinnati Ball Crank Co., Cincinnati, Ohio, has introduced a new line of deluxe lubricating equipment. Available as individual units or in groupings to form an entire lubrication department, the new equipment features unusually attractive cabinets. Many combinations include set-ups with desk, work bench and even a deluxe oil bar with several grades of oil "on tap."

Correction

The most widely used firing order for six-cylinder engines is 1-5-3-6-2-4, and not 1-2-4-6-5-3, as erroneously stated in the article on Socking Couples in Six-Cylinder Single-sleeve Valve Engines, in our issue of August 1. I want to thank those who called attention to this slip—*P.M.H.*

Truck Production by Capacity

(U. S. and Canada)

	SIX MONTHS		
	Units		Per Cent of Total
	1941	1940	1941
1½ Tons and less	553,750	392,268	84.42
2 to 3 Tons	69,968	26,973	10.67
3½ Tons and over	12,005	7,787	1.83
Special and buses	7,330	3,536	1.12
Station Wagons	12,840	9,160	1.96
Total	655,893	439,724	100.00

Passenger Car and Truck Production

(U. S. and Canada)

	June 1941	May 1941	June 1940	SIX MONTHS 1941	SIX MONTHS 1940	SIX MONTHS Per Cent Change
Passenger Cars—U. S. and Canada:						
Domestic Market—U. S.	408,424	408,885	276,949	2,367,429	1,959,148	+21.0
Foreign Market—U. S.	10,559	8,813	9,091	60,173	68,282	− 11.9
Canada	8,538	9,840	8,739	65,199	72,286	− 9.8
Total	427,521	427,538	294,779	2,492,801	2,099,716	+18.6
Trucks—U. S. and Canada:						
Domestic Market—U. S.	86,005	87,552	49,505	491,150	334,953	+46.8
Foreign Market—U. S.	15,533	13,498	9,091	77,071	66,145	+16.3
Canada	17,215	16,745	9,191	87,672	38,626	+127.0
Total	118,753	117,795	67,787	655,893	439,724	+49.4
Total—Domestic Market—U. S.	494,429	496,437	326,454	2,858,579	2,294,101	+24.7
Total—Foreign Market—U. S.	26,092	22,311	18,182	137,224	134,427	+ 2.1
Total—Canada	25,753	26,585	17,930	152,871	110,912	+38.0
Total—Cars and Trucks—U. S. and Canada	546,274	545,333	362,566	3,148,694	2,539,440	+24.1

Passed by Canadian Censor

Canada's M-3 Cruiser Tank

Here is Canada's latest contribution to modern warfare, a M-3 cruiser tank, which is nearly 20 ft. in length and weighs as much as a railway freight car. Tanks of this size are being built by the Montreal Locomotive Works, Ltd.

Jessop Steel Co. Expands

Construction of a new 84-in., two-stand plate mill has been started by Jessop Steel Co. at its Washington, Pa., plant. This electrically-driven plate mill will be supplemented by six modern heat treating furnaces capable of increasing plate production 50 per cent. Also under construction at the Jessop plant is a new building for the storage of billets, ingots, scrap and other raw materials. Already completed are two modern gas-fired annealing furnaces in the bar mill and an ingot furnace in the cogging mill.

Monthly Motor Vehicle Production

(U. S. and Canada)

	PASSENGER CARS		TRUCKS		TOTAL MOTOR VEHICLES	
	1941	1940	1941	1940	1941	1940
January*	423,223	375,476	100,835	74,016	524,058	449,492
February*	405,160	350,535	104,166	71,690	509,326	422,225
March*	422,289	364,947	111,560	75,285	533,849	440,232
April	387,070	375,626	102,784	76,807	489,854	452,433
May	427,538	338,353	117,795	74,139	545,333	412,492
June	427,521	294,779	118,753	67,787	546,274	362,566
Total	2,492,801	2,099,716	655,893	439,724	3,149,694	2,539,440
Total for Year	.....	3,802,454	.....	889,884	.....	4,692,338

*—1941 data revised.

PUBLICATIONS

Synthane Corp. has a new folder on its **silent stabilized gear materials.** It describes the principal properties of Synthane grades most used for gears, has six charts for figuring hp. transmissible by Synthane gears.*

A new 8-page booklet by Westinghouse describes **coupled reduction gears** for driving compressors, line shafts, generators, etc.*

General engineering data, including operating characteristics for various standard size **"Torflex" flexible bearings,** are given in a folder issued by Harris Products Co.*

A new **Contour Sawing Handbook,** published by Continental Machines, Inc., contains information on contour sawing and its application.*

S. G. Taylor Chain Co. has released a new series of bulletins, in catalog form, illustrating and describing the many types and grade of **chains** made by it.*

"The Fast, Modern Way to Drill", a new bulletin showing the latest U14 type quarter inch capacity, small, light, one-hand electric drills, has been issued by Independent Pneumatic Tool Co.*

An **Electric Arc Weldrule** of interest to engineers, supervisors, etc., is announced by General Electric Co. It operates similar to a slide rule and contains a selector chart showing the various metal classifications as specified by the American Welding Society and types of electrodes which meet these classifications.*

Knu-Vise **Toggle Action Clamping Fixtures** is the subject of a new catalog released by Knu-Vise, Inc. It features 22 different models of clamps, pliers, riveters, drill fixtures, etc.*

American Lava Corp. has issued a chart containing the properties of ceramic insulating materials.*

The July issue of Grits and Grinds, by Norton Co., contains a comprehensive article on **Thread Grinding.** Also just released by Norton Co. is a handbook on reconditioning and sharpening single point cemented carbide tools rapidly and economically.*

Automatic Transportation Co. has compiled a booklet showing the various uses for its material handling equipment—power trucks, tractors and cranes.*

North American Electric Lamp Co.'s folder "Drying Problems Made Easy" gives typical examples and illustrations in the use of **infra-red ray drying and heating.***

* Obtainable through editorial department, AUTOMOTIVE INDUSTRIES. Address Chestnut and 56th Sts., Philadelphia. Please give date of issue in which literature was listed.

May New Passenger Car Registrations and Estimated Dollar Volume by Retail Price Classes*

PRICE CLASS	NEW REGISTRATIONS								ESTIMATED DOLLAR VOLUME							
	MAY				FIVE MONTHS				MAY				FIVE MONTHS			
	Units		Per Cent of Total		Units		Per Cent of Total		Dollar Volume		Per Cent of Total		Dollar Volume		Per Cent of Total	
	1941	1940	1941	1940	1941	1940	1941	1940	1941	1940	1941	1940	1941	1940	1941	1940
Chevrolet, Ford and Plymouth	265,082	189,697	51.49	54.95	1,058,184	818,869	52.32	54.77	$215,600,000	$145,100,000	45.27	48.67	$870,522,000	$626,000,000	48.72	48.43
Others under $1,000	96,671	109,745	18.78	31.79	376,705	477,155	18.62	31.92	89,100,000	99,200,000	18.71	33.27	257,908,000	431,900,000	14.43	33.41
$1,000 to $1,500	143,831	43,401	27.95	12.57	551,528	188,138	27.27	12.58	155,800,000	49,000,000	32.72	16.44	596,252,000	212,900,000	33.37	16.47
$1,501 to $2,000	7,692	1,501	1.49	.44	30,107	6,766	1.49	.45	12,100,000	2,700,000	2.54	.91	47,288,000	11,800,000	2.65	.91
$2,001 to $3,000	1,490	842	.29	.25	6,168	3,981	.30	.28	3,600,000	2,100,000	.76	.70	14,874,000	9,700,000	.83	.75
$3,001 and over	.....	5	.....	.....	.....	61	.....	.....	.....	25,000	.....	.01	.....	315,000	.....	.03
Total	514,766	345,191	100.00	100.00	2,022,692	1,494,970	100.00	100.00	$476,200,000	$298,125,000	100.00	100.00	$1,786,844,000	$1,292,615,000	100.00	100.00
Miscellaneous	268	557	.....	.....	1,119	1,229	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Total	515,034	345,748	.....	.....	2,023,811	1,496,199	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

* All calculations are based on delivered price at factory of the five-passenger, four-door sedan, in conjunction with actual new registrations of each model. The total dollar volumes are then consolidated by price classes.

7 REASONS WHY TELEGAGES ARE MORE *Accurate* AND *Durable*

The following are some of the reasons why King-Seeley Telegages have steadily increased in accuracy, reliability and durability:

1. Designed to perform consistently, even though variations in the electrical circuit range from 4 to 9 volts.
2. Built to withstand eight hours of continuous vibration in two planes with the testing machine ranging from 0 to 6000 R.P.M.
3. Oil plug diaphragm metal especially constituted to withstand 10,000,000 stress reversals under loads varying through the full pressure range.
4. Entire assembly built to function over a temperature range of -10° F. to 125° F. with an over-all loss in accuracy of not more than 4%.
5. Adoption of spun glass heater wire insulation as insurance against damage from temporary "shorts".
6. Metal floats chosen in order to maintain initial buoyancy indefinitely.
7. Corrosion-free metal selected for tank arm and bearings to eliminate any tendency to stick.

KING-SEELEY TELEGAGES
SHOW FUEL LEVEL, OIL PRESSURE AND WATER TEMPERATURE
Transmission is entirely by Wire—No Tubes

KING-SEELEY CORPORATION
ANN ARBOR MICHIGAN
SUPPLIERS OF ORIGINAL AUTOMOTIVE EQUIPMENT SINCE 1922

OTHER PRODUCTS
INSTRUMENT PANELS • SPEEDOMETERS • GOVERNORS

World's Largest Roller Bearing

Four of these tapered roller bearings, manufactured by Timken Roller Bearing Co., are to be installed on the back-up rolls of the new, 4-hi reversing hot mill of the Aluminum Co. of America at Alcoa, Tenn. They are said to be the largest ever built and have a mill separating force capacity of 8,300,000 lb. at mill speed, which is 30 per cent more than the previous record.

These bearings have a 35½ in. bore, 51 in. outside diameter, and a width of 36 in. Each bearing weighs 9070 lb. and is a four-cage assembly with 34 machine-turned, case carburized rolls per cage. Individual rolls are 4 in. in diameter, 7¼ in. long and weigh 23.37 lb. The cones and cup are forged. The cages are turned.

Harley Allison, production dept. employee, is holding the smallest Timken tapered roller bearing used on automobile generators.

Beryllium-Copper Brush Springs

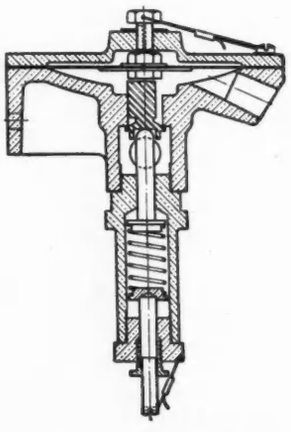
Commutator-brush springs made of beryllium copper are now being manufactured by Instrument Specialties Co., Inc., Little Falls, N. J. An advantage claimed for them is that they have higher safe operating temperatures than bronze, music-wire or stainless springs, and have more than twice the current-carrying capacity of bronze. In production quantities these springs are supplied to the following tolerances: Length, plus and minus 1/32 in.; outside diameter, plus and minus 0.003 in.; load deflection, 5 per cent.

Springs are uniform in pitch and can be compressed to within ⅛ in. of solid length without coils touching. Because the springs are sufficiently straight to roll easily across a flat surface, friction against brush-holder is reduced. Higher safe working stresses allow springs to be redesigned for greater free lengths, thus reducing the change in brush pressure with brush wear. Being heat-treated for minimum drift, these beryllium-copper brush springs are claimed to maintain their initial tension without set.

Special heat-treating routine results in such high conductivity as to eliminate the necessity for shunts or pigtails in many instances. Close tolerance on diameters assures firm and positive contact with carbon brush with an interference fit of only 0.005 to 0.008 in.

Zoder Fuel Safety Valve for Marine Powerplants

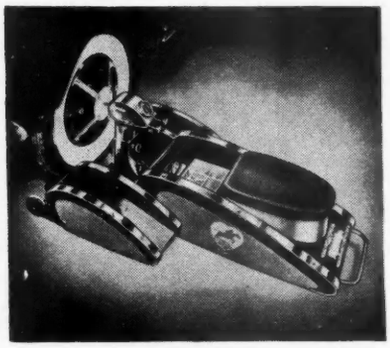
Zoder, Inc., St. Louis, Mo., has developed a valve which automatically shuts off fuel flow in marine powerplants whenever the engine stops and thus prevents loss of fuel in the event of a broken or leaking fuel line. A section of the Zoder valve is shown herewith. It is inserted in the fuel line at the fuel tank. The valve is normally held closed by a spring and then prevents fuel from getting out of the tank. Hence, in the event of a break or leak in the fuel line, no gasoline can get out, which under normal conditions would be likely to result in the formation of a dangerous explosive mixture in the hull. As soon as the engine is started, the suction of the fuel pump, acting on a diaphragm in the valve, lifts the valve and then permits free flow of fuel to the pump. Fuel inlets are provided on both sides of the valve for convenient installation.



Sectional view of Zoder safety valve

Roto-Graph Wheel Balancing Equipment

Equipment which makes it possible to determine the out-of-balance of car wheels on the car and to correct same has been developed by Hunter-Hartman Corp., St. Louis, and is being marketed under the trade name "Roto-Graph." As shown by the illustration, herewith,



Roto-Graph wheel balancer

it comprises a built-in wheel spinner that will spin the wheel on the car up to a speed of 125 m.p.h., the spinner being controlled by a switch operated by a built-in pedal. Wheel speed can be reduced as desired by means of a foot-controlled built-in brake. The tool and weight kit also are built in, for convenience in operation. There is, moreover, a built-in cushioned seat for the operator. A spot light carried on the instrument carriage illuminates the graph disk. Wheels are engaged by means of an adjustable snap-on adapter that fits wheels on all types of passenger cars and light trucks. Records are produced by a built-in ever-sharp coined silver marker. The equipment includes a speedometer which records the speed regardless of the direction of wheel rotation. Two 5-in. ball-bearing casters at the front of the device make for portability. The equipment operates on 110 volt a.c. single-phase.

Colored Permocharts

The Permochart Co., Sewickley, Pa., announces production of the new I-EZ (eye-ease) Permochart, an improved design of recording instrument chart made for continuous re-use. It is made in three colors of "Vinylite" plastic, so colored and shaded as to reduce glare and eyestrain to a minimum. The three colors, green, ivory and blue, can also be used to advantage in identifying different units or operations, making inspection of charts easier.

A hand tool manufacturer makes both his striking and socket wrenches from Chrome-Molybdenum (SAE 4140) steel. He gets the toughness needed for striking wrenches even at the relatively high hardness of 35-38 Rockwell "C". His socket wrenches resist deformation because of a Rockwell "C" hardness of 46-48.

Availability, economy, and quality are nicely combined with versatility in this one steel.

Our free technical book, "Molybdenum in Steel" will be sent to those interested.

CLIMAX FURNISHES AUTHORITATIVE ENGINEERING DATA ON MOLYBDENUM APPLICATIONS.
MOLYBDIC OXIDE—BRIQUETTED OR CANNED • FERROMOLYBDENUM • CALCIUM MOLYBDATE

Climax Molybdenum Company
500 Fifth Ave. • New York City

MOLY

Teamwork

(*Continued from page* 13)

machine forgings and weld parts for the North American airframes, while the Chevrolet forge plant at Muncie, Ind., will supply aluminum forgings.

Chrysler Corp., which has undertaken to manufacture the nose and center fuselage sections of the B-26 two-engine medium bomber, has had its engineers and draftsmen at the Glenn L. Martin Co. plant in Baltimore studying the 8500 blueprints required for this plane's airframe. These two sections of the plane comprise about 25 or 30 subassemblies. Many Chrysler divisions are cooperating, with the DeSoto Division slated to manufacture 1500 different parts and the Plymouth Division supplying 250 parts. In addition, the Chrysler-Jefferson plant in Detroit, the Airtemps Division at Dayton, Ohio, and the drop forge plant at Newcastle, Ind., will participate in the program. Complete subassemblies will be shipped to the Glenn L. Martin-Nebraska Co. plant at Omaha.

Hudson, which will make the rear fuselage section for the B-26 bomber in the old axle plant at Detroit, also has had engineers at the Martin Baltimore factory studying production methods.

Douglas Aircraft Co., Inc., which was the first to take advantage of the automobile industry's productive capacity by granting subcontracts for airframe parts to Briggs Mfg. Co. and Murray Corp. of America, has maintained a Detroit office since last fall for coordinating these activities with those of the Douglas plant at Santa Monica, Cal. In addition to the Douglas subcontracts, Briggs and Murray also are supplying airframe parts for Boeing four-engine bombers, and Briggs has done some work for Vought-Sikorsky on dive bombers.

Packard in Production

(*Continued from page* 42)

40-mm. anti-aircraft gun which Chrysler has contracted to make. This is designed to save time and alleviate pressure on the hard-pressed machine tool industry.

Willys-Overland Motors, Inc., has received a Government order for 16,000 more ¼-ton reconnaisance cars (blitz buggies) valued at $13,411,864. The company has just completed an initial order for 1500 units. This award brought a protest to the Senate committee investigating defense from Francis H. Fenn, president of American Bantam Car Co., who maintained that his company pioneered in the development of this vehicle. Records showed, however, that Willys underbid Bantam by $40 per car. Bantam and Ford each has had orders for 2500 blitz buggies.

Yellow Truck & Coach Mfg. Co. has received another order for $41,672,451 for 6x6 2½-ton army trucks, bringing total truck orders to more than $180,000,000. Hudson Motor Car Co. has been granted a $14,038,400 contract for naval ordnance. Holley Carburetor Co., Detroit, has been granted a Defense Plant Corp. award of $661,415 for facilities to produce aircraft parts and American Bosch Corp., Springfield, Mass., has had its D. P. C. agreement boosted to $2,118,608 for defense production.

Recent national defense orders include $11,751,986 to Kelsey-Hayes Wheel Corp. for small arms material to be produced at its new Plymouth, Mich., plant; $7,652,971 to Mack Mfg. Corp. for tank assemblies and truck parts; $3,921,651 to Continental Motors Corp. for engines; $14,595,475 to Diamond T Motor Car Co. for tank carriers, personnel carriers and truck parts; $1,884,923 to Stewart-Warner Corp. for fuses; $677,396 to Noblitt-Sparks Corp. for casings; $1,169,598 to Ford Motor Co. for 1½-ton trucks; $2,260,940 to Chrysler Corp. for ½-ton trucks; $824,670 to Federal Motor Truck Co. for trucks; $772,288 to Rolls-Royce, Inc., Detroit, for ball and roller bearings; $595,000 to Auto Specialties Mfg. Co. for shells; $553,932 to King-Seeley Corp. for fin assemblies; $460,010 to Motor Wheel Corp. for shells; $2,442,355 to New Departure Division of GM for aircraft parts; $2,916,024 to White Motor Co. for personnel carriers; $4,519,531 to Autocar Co. for personnel carriers.

Mass Production of Airplanes

(*Continued from page* 27)

economically, as the chain is in use completely around the circuit. Electric wiring and plumbing are simplified, as a single outlet serves both sides of the loop. Daylight type of lighting is more effective, since the "spill over" from one side aids the other. Supervision is simplified because a single supervisor can see all the workers on the line.

Branch lines are of the same type of tramrail as the sub-assembly loops, so that the finished sub-assembly can be transported to the final assembly line without ever removing it from its original carrier. Adjustment in elevations for positioning preparatory to attaching one assembly to another is accomplished with drop sections or similar devices. For example, the power plant is assembled on a conveyor line located on a mezzanine floor; it is transported on a feeder line at mezzanine height out to the final line where it is dropped 15 feet on a tramrail drop section to meet the air-frame positioned below. The drop section being suspended from two cables permits swinging the power plant from one side or the other for the purpose of alining bolt holes, and the carrier may be rolled a limited distance forward or backward along the drop section to bring the power plant up to the attachment fittings.

An interesting variation of a lift section is employed for bringing together the fuselage, monocoque and center section assemblies. A section of tramrail bearing the fuselage and its carrier is lifted from sockets by means of two independent hoists attached to either end of the section. The hoists are suspended from a crane bridge used to transfer the fuselage to a position directly in front of the monocoque, which is suspended in its carrier at the end of a rail with attachment fittings facing out. The fuselage is raised, or lowered or tipped by means of the two independent hoists until the attachment points line up. The two assemblies are then bolted together. The total load is shifted to the fuselage carrier and the monocoque carrier pushed back out of the way. The unit is moved over onto the center section where the two are bolted together, thus completing a skeleton air frame with landing gear and tail wheel. The air frame is lowered to the floor, the fuselage carrier is unclamped and returned by means of the lift-out section and crane bridge to its starting position. Never once has any assembly been out of its carrier until it has been bolted fast, nor has the air frame been supported by anything other than one or more of the original carriers. By this means maximum safety is provided at all times.

Major sub-assembly line tramrails are held as close to the floor as possible in order to obtain maximum stability of the carrier. The closer the rail is to the work the less the strain will be on the outrigger and carrier. The power plant assembly tramrail is 8 feet above the floor, while the monocoque-empenage is 12 feet in order to clear the vertical fin.

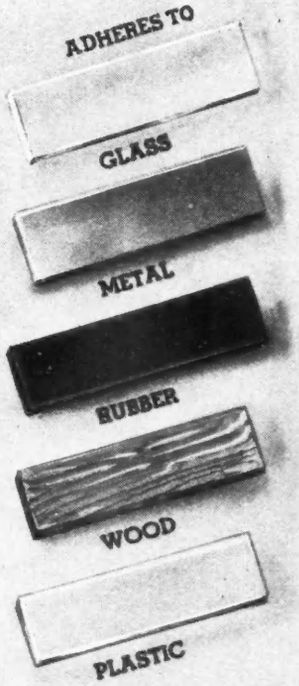
Intermittent motion is employed on some of the sub-assembly lines. It has advantages over continuous motion for certain types of assemblies, particularly where extreme stability is required, as in arc welding of tube structures. It has an advantage on the monocoque-empenage line because the assembly is extremely light for its size and does not have sufficient weight in itself to obtain stability in the ordinary manner. In this case, the carrier is locked to the rail during each work period. The stability acquired makes it possible to check the angles of the control surfaces with a spirit level.

The production line has been in operation for such a short time exact figures on possible output from this plant, operating under the new streamlined methods, are not as yet available for release, but suffice it to say that production of military planes by this plant has been increased fourfold.

GLASS SEALER

TRANSPARENT

SEALS WINDSHIELDS and WINDOWS



Extreme summer heat, sub-zero cold, driving rains or melting snows play havoc with the metal frames of windshields and windows of automobiles.

Loose weatherstripping, loose glass or cracked glass hold water in contact with metal window frames for long periods. Unless water and air are excluded, corrosion will start and will never stop.

The prevention of water seepage under such conditions was an impossible task until the problem was solved by the Research Department of the Permatex Company.

Permatex Glass Sealer forms a transparent bead or film that immediately sets into position, dries rapidly, adheres strongly and remains tough, pliable and waterproof.

Available in 1 ounce and 5¼ ounce tubes.

PERMATEX COMPANY, INC. Sheepshead Bay, N. Y., U. S. A.

Automotive Materials

(*Continued from page* 33)

yard varying from 0.595 to 3.62 lb.

Plating on Non-Metallic Objects

WILLIAM T. JOY & CO., 1170 Broadway, New York, has developed a process of plating non-metallic articles such as plastics, glass, porcelain, wood, etc. This process, it is believed, will find application in the automotive industry, especially in connection with body moldings. The article to be plated must first be cleaned and is then sprayed with a chemical solution to give it a conducting coating, after which it can be plated in a normal acid bath. Thus wood or plastics moldings can be given a metallic appearance. The process can be used also to strengthen light moldings or hollow ware by depositing coatings of from 0.005 to 0.007 in. thickness. It is believed that the process will appeal specially at the present time on account of the scarcity of various metals, as it will permit of replacing metallic articles, such as moldings, by moldings of non-metallic material provided with a metal coating giving the same appearance as the original. In this way considerable quantities of metal might be saved. Special stress is laid on the firm adherence of the coatings.

The company does not intend to engage in plating operations for the industry, but to issue licenses for the use of its patents. It has facilities for demonstrating the process.

Aluminum Alloy Rivets Keep Soft in Dry Ice

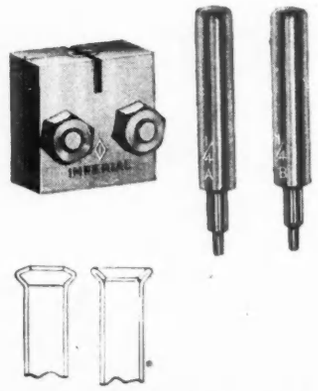
THE ALUMINUM alloy rivets which are being used by the thousand in modern all-metal airplanes are set while chilled by dry ice. The alloy of which they are made has the property of age hardening. The material in wire form is annealed to soften it and can then be readily formed into rivets and set, but when kept at room temperature the rivets harden and toughen during a period of several days, so that it is impossible to set them properly. Therefore, after the rivets are formed in an automatic machine, from a reel of wire, and properly annealed, they are placed in a cold room where age-hardening is prevented by the low temperature. From the cold rooms these rivets are transferred in small batches to containers cooled by dry ice, located along the assembly line, so that they are kept at the proper low temperature right up to the time of setting. The hardening, of course, is due to a change in grain structure which apparently is inhibited by the low temperature.

Hand Protective Cream

MITTS, a product of Mitts Manufacing Co., Brooklyn, N. Y., is a water-soluble hand cream that is applied to the skin before starting work. It dries quickly and acts as an invisible glove, guarding the hands from grease, paint, ink, and other matter difficult to clean; it also protects the hands from many irritating materials which cause industrial skin trouble. Mitts washes off easily with soap and water taking all dirt with it.

Double-Flaring Tool for Tubing

A new type of flaring tool, designed specially for making approved-type double flares on Bundy steel tubing for fuel line and brake-line connection work has been announced by the Imperial Brass Mfg. Co., Chicago. The tool is claimed to absolutely prevent splitting the ends of the tubing, because it folds back the ends to make a flare with double thick walls. One operation of the tool bells out the ends of the tubing and another folds it back into the correct double flare. Flaring can be done in very close quarters. While the new tool was developed especially for flaring Bundy steel tubing, it can be used also for copper, brass or aluminum tubing.



Imperial Double-Flaring Tool

Three sizes of "Double-Flaring" tools are available, for tubing, ¼ in., 5/16 in., and ⅜ in. in diameter. Each size includes one die block to hold the tubing in position, and two punches.

MEN and MACHINES

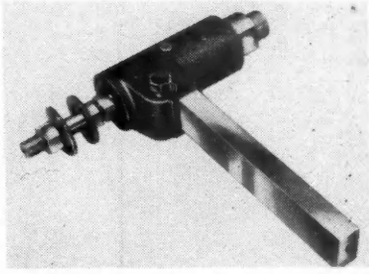
(*Continued from page* 37)

serves to hold the tooth being ground in contact with the tooth rest while feeding the cutter across the wheel by longitudinal table movement. The spindle is mounted on anti-friction bearings, which is of advantage particularly when sharpening very small end mills having a steep spiral.

The attachment spindle is carried in a body that can be set at an angle in both a horizontal and a vertical plane, and rigid clamping is provided for both adjustments: End mills having a No. 9 B & S taper shank will fit directly into the attachment spindle, while cutters having shanks of other tapers, or straight shanks, are accommodated by collets and adapters available at extra cost. A draw-in bolt for use with spring collets for holding straight-shank end mills is another extra.

Radius wheel truing attachments for its plain grinding machines No. 5, Nos. 10 and 12, and Nos. 20, 22 and 23, also have been announced by Brown & Sharpe. These attachments constitute a ready means of forming wheels for grinding to shoulders where a fillet of up to ½-in. radius is required.

A NEW tool-post attachment for lathes, driven by a Stow portable flexible-shaft machine, is being produced by Stow Manufacturing Company, Inc, Binghamton, N. Y. By this means, a lathe may be adapted to many different grinding operations, both external and internal. The device accommodates grinding wheels of up to 6 in. diameter by 1 in. face. By taking off the clamp spindle and substituting the Stow collet chuck, a variety of mounted wheels and points may be operated for internal grinding and recess surfacing.



Stow Tool-Post Attachment

NEW METHODS of spotfacing and boring are made possible by the introduction of the B & B spotfacer and boring tool by the manufacturers, the Bokum Tool Co., Detroit. It consists of a head (or bar) with a cutting blade extending through a slot at one end, at right angles. Located on the head is a dial with micrometer readings, which enables the operator to set and lock the blade securely to precise diameter measurements, within one ten-thousandth of an inch.

The tool is made in three models, with standard blades giving a boring range up to 22 in. diameter. A wide range of spotfacing is also possible.

ID RATHER BE RIGHT THAN BE LEFT

ALTER EGO: Literally, "one's other self"—the still, small voice that questions, inspires, and corrects our conscious action.

Sure there's going to be some scrambling when we get back on a 40-hour week. It will be time enough then to consider whether we'd be right in changing to arc welding.

ALTER EGO: There won't be time enough then to even consider what hit us.

You mean it will take us a long time to get into welding production?

ALTER EGO: I mean it has taken us far too long already to get into welding *prediction*. Prediction as to what will happen to designs and production methods now that all our friends are going great guns with welding for land, sea and air equipment.

There's no doubt about it, they're getting well up in the welding art.

ALTER EGO: Yes, they're learning the knack in the nick of time. And if we don't have the foresight to get into this *right* away—we'll be *left*, holding the bag . . . on which the closure is foreclosure.

• •

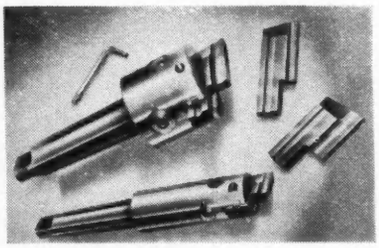
LINCOLN SUGGESTS: The *quickest, surest* way to get things accomplished with welding is: Appoint a man of experience and authority to supervise changeover of one part at a time. If this is done, the problem of how to get going will solve itself. We *guarantee* this plan to be profitable. For details, see Page 1, "How to Change Over to Welded Design for Profits".

Copyright 1941, The Lincoln Electric Co.

LINCOLN "SHIELD-ARC" WELDING
THE LINCOLN ELECTRIC COMPANY
Cleveland, Ohio
Authoritative Information on Design • Production • Welding Equipment

With the aid of a standard small-tool adapter, the same tool can be used to bore holes as small as ¼ in. in diameter. By using blades with step formation, many different diameters may be bored on the same axis, and steps or shoulders may be faced at the same time.

A special adaptation of the same tool—the B & B line borer—with a shank tapered at both ends, can be used to advantage in boring long holes. One tapered end is placed in the spindle in the conventional manner, while the other—forming the support—is entered in the taper-bored end of a plain shaft. This latter may extend beyond the work to any bearing support. The tool also permits the bar itself to provide the front pilot.

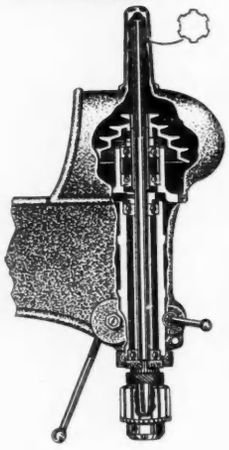


B & B Spotfacer and Boring Tool

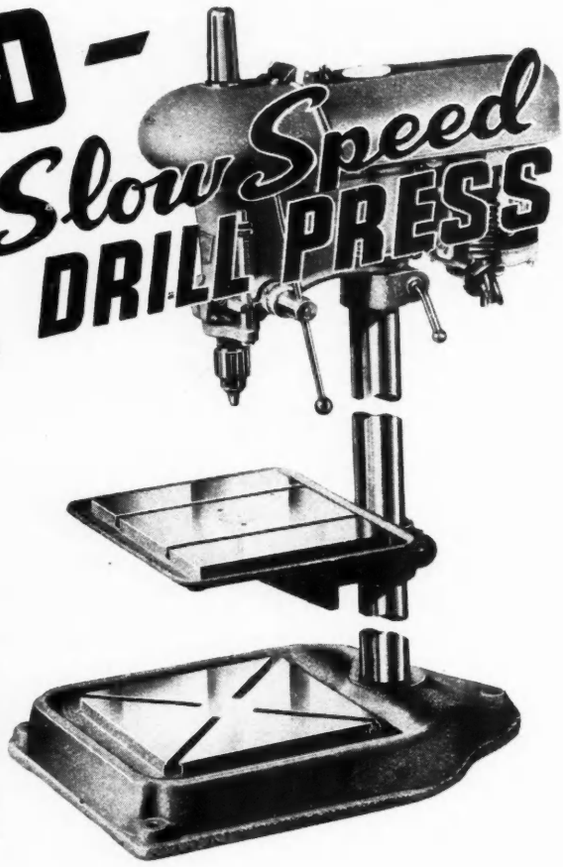
DURO-

STALWART IN CONTINUAL SERVICE

Slow Speed DRILL PRESS



A vital part of any drill press is the head. Here Duro gives you exceptionally fine construction. All parts are rigid and heavily made to withstand stresses and strains. The 2" diameter quill rotates on four sets of pre-lubricated New Departure Ball Bearings. The cast iron housing in which the pulley assembly is mounted is an integral part of the main head casting. Feed lever actuates a spur gear pinion which engages a rack cut in the quill.



BUILT with extreme precision for precision work. Modern in design—ruggedly constructed, possessing extra stamina for heavy work. Features responsible for the unexcelled performance of Duro Drill Presses are: Large sturdy steel column; extra size castings; full ball bearing 6-spline spindle; V-belt drive; controlled speed pulleys; large table and base. Their initial cost is low, their operating efficiency is high. It will pay you in dollar return to equip your shop with Duro Tools. Ask for Duro's new catalog.

ASK FOR DETAILS

DURO METAL PRODUCTS CO.

DEPT. AI-8, 2649 N. KILDARE AVE.

CHICAGO, ILLINOIS

ELECTRIC-CONTACT gages have been developed by Pratt & Whitney to make possible rapid inspection of quantity-produced articles. Each gage is designed for a particular job, and the principle of the instrument is explained herewith as applied to the inspection of shells. A single operation checks all outside dimensions. (*See illustration on page* 37.)

The electric-contact shell gage comprises the signal box, the gaging fixture, and the masters. The gaging fixture is composed of a base with positioning slide or ways, and a vertical column to which are attached the adjustable gaging sections. In most cases the gaging sections are supported independently by parallel flat springs. As the shell is slid into gaging position, each of the floating sections automatically aligns itself, producing an accurate diameter check regardless of possible eccentricity between the several dimensions. Each gaging section has a fixed anvil and a movable spindle which actuates the contact arm. The light contacts are readily adjustable so that diameter tolerance can be set quickly and easily.

Maximum and minimum masters are furnished with the gage for setting purposes. These are made in sections for manufacturing purposes, but are the equivalent of solid masters when assembled. The lights on the signal box show instantly whether the dimensions conform to specifications.

Several P. & W. electric contact gages have been in use in the automotive industry for inspecting pistons for a number of years. The gage recently has been adapted also for checking the angle and position of airplane propeller hubs.

IMPROVEMENTS in their various grades of Kennametal steel-cutting tool carbides have been made by McKenna Metals Company, Latrobe, Pa. The new hardness and strength values for the four standard grades of Kennametal are as follows:

Grade	Rockwell C	Rockwell A	Strength Trans. Rupture lbs. per sq. in.	Thermal Conductivity
KM	77.6	90.8	350,000	0.113
KH	78.6	91.3	275,000	0.074
K3H	79.6	91.8	260,000	0.068
K4H	80.6	92.3	225,000	0.110

Kennametal grade KM is used in lathes and boring tools for machining alloy-steel and carbon-steel forgings, castings and bar stock—for both continuous and interrupted cuts. Grade KM, which is exceptionally strong, can be used for shaping hard armor plate, as well as for turning and facing over interruptions. This grade is widely used in shell-turning tools.

Kennametal grades KH and K3H are used on light finishing cuts or where the steel being cut is very soft (SAE 1010, SAE 1020, or free-machining steels). Grade K4H is extremely hard and is

5

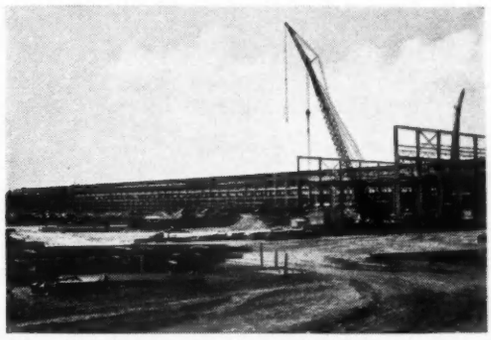
ALUMINUM, DEFENSE, AND YOU

GENTLEMEN, BEHOLD A PARADOX!

ONE POUND OF CIVILIAN ALUMINUM becomes one pound of Defense Aluminum by the simple process of writing the magic symbols AA to A-10 on certain pieces of paper.

THIS DEFENSE ALUMINUM we are making is not special aluminum; it is just good old Alcoa Aluminum in especially *large* quantities.

HOW LARGE? Each pound of civilian aluminum shipped in the average month of 1930-38 has been multiplied into almost four pounds a month for defense. And this was possible only because we started to spend over $200,000,000 for expansion long before today's needs became generally recognized.

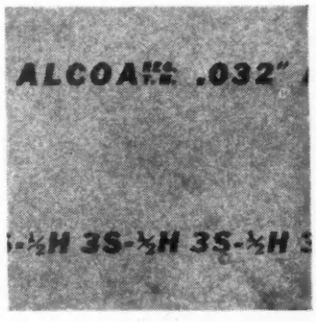


The 2400-foot-long rolling mill being constructed at Alcoa, Tennessee. This new 57-acre plant will bring our sheet rolling capacity up to more than 33,000,000 pounds per month.

HERE'S THE PARADOX: Civilian Aluminum is exactly what we are making; Defense Aluminum is what we are shipping—and a great deal of it.

DEFENSE DOES NOT ASK FOR different aluminum; it could not ask for better aluminum. It asks only more of the same. We are happy to report that defense industries asked for and got from us something like twenty million pounds *more* last month than were forecast in schedules set up six months ago.

DEFENSE ORDERS specify aluminum in the old familiar way, using the same train of tried and true Alcoa Alloy numbers—2S-3S-11S-17S-24S-52S-195-356, and all the rest. They do the same things superlatively well, for Defense, that they have been doing for you.



WHEN ALUMINUM COMES BACK into civilian use, it is going to be very like switching this crack train of Alloys of Alcoa Aluminum right back on your track.

BUT THERE WILL BE SOME SURPRISES aboard. New techniques, new economies, are being sought, found, and already put into use by our busier-than-ever researchers. Probably there will be a new alloy or two. Certainly, there will be many new ways to use the old ones, profitably.

ALUMINUM COMPANY OF AMERICA

used for precision boring of steel with light cuts.

THE EDWARD BLAKE COMPANY, Newton Centre, Mass., announces new No. 1 and No. 2 J-B tap grinders and a new J-B tap-grinder knee-room pedestal. These machines are designed for sharpening taps on the chamfer. They will sharpen two-, three-, four-, and five-flute taps and may be equipped for grinding six-flute taps or six-, eight-, or ten-flute taps. Both right- and left-hand taps may be sharpened.

Taps may be inserted or removed from the machine in a few seconds, and a simple locating device insures correct positioning and duplication of work. The desired relief is obtained by a simple screw adjustment of an eccentric mechanism. The motor head unit may be swiveled in a wide arc on any desired chamfer angle.

J-B Tap Grinders are furnished complete with motor, two grinding wheels, wheel guards, diamond wheel dresser, wrenches, one draw-in master collet, and two bell centers.

The knee-room pedestal is offered as an optional extra.

THE FREDERICK POST CO., Chicago, announces the new True Line drafting machine, which embodies a protractor, a vernier, a T-square, scales and triangles. An advantage claimed for this machine is that it eliminates smudging and blurring caused by moving instruments over the drawing. The new machine is equipped with "Quick Flick" controls, the scales being released by a flick of the thumb for 15-degree automatic stops, or for intermediate stops and locking. The design permits the use of the instrument with the elbow to the left or right. The protractor may be used at any angle in the complete circle, so that the total area of the board is made accessible.

THE GEORGE SCHERR CO., New York, has made an addition to its line of precision length standards, known as the Ultra Chex Inspectoset. The set consists of 34 gage blocks which will make up about 80,000 combinations in steps of 0.0001 in., from 0.3000 to 8 in. An optical flat, which is used for checking gage blocks, micrometer anvils and other lapped surfaces for parallelism and planeness, is also furnished with the set.

THREE special vibro-insulators are announced by the B. F. Goodrich Co., Akron, O. Type 44 is for use with gas burners, Type 50 is designed to damp out torsional vibration in internal-combustion engines, and Type 60 is designed to reduce vibration and noise in exhaust and intake fans. The torsional vibration damper, Type 50, is so designed that it will damp out vibrations with a minimum frequency of 1000 cycles per minute, and is made in 35, 40, 50 and 60 durometer hardness. Type 60 is a compression mounting and is recommended for loads up to 240 lb. and has a ¾-in. deflection under this load.

CRATER formation in metallic arc welding is caused by abrupt braking of the welding arc, which does not give the molten metal at the end of the deposit an opportunity to free itself of gases and slag. The metal in the crater area is porous and there is a distinct depression in the contour of the deposit. Wilson Welder & Metals Co., New York, announces the "Stroco" electric-arc crater eliminator, which is mounted on the body of the arc-welding generator. It is connected in series with the excitation field of the generator and controlled by a switch which enables the operator to cut it in and out of the excitation field circuit at will. When introduced into the circuit it functions as a variable resistance of large-enough capacity to build up the resistance in the excitation field and thus lower the excitation field, thereby making it possible to reduce the current density gradually without disturbing the current setting of the welding generator. It is thus possible to accomplish a tapering off or a fading of the current instead of an abrupt change. The weld deposit made under these conditions is said to be free from porosity at the end, and to have a smooth even contour.

Pre-Cast Bearing BRONZE ON STEEL was developed to meet the present day bearing requirements of manufacturers in every type of industry. It enables you to increase speeds and loads . . . to gain longer life and smoother operation . . . plus greater resistance to shock and to wear.

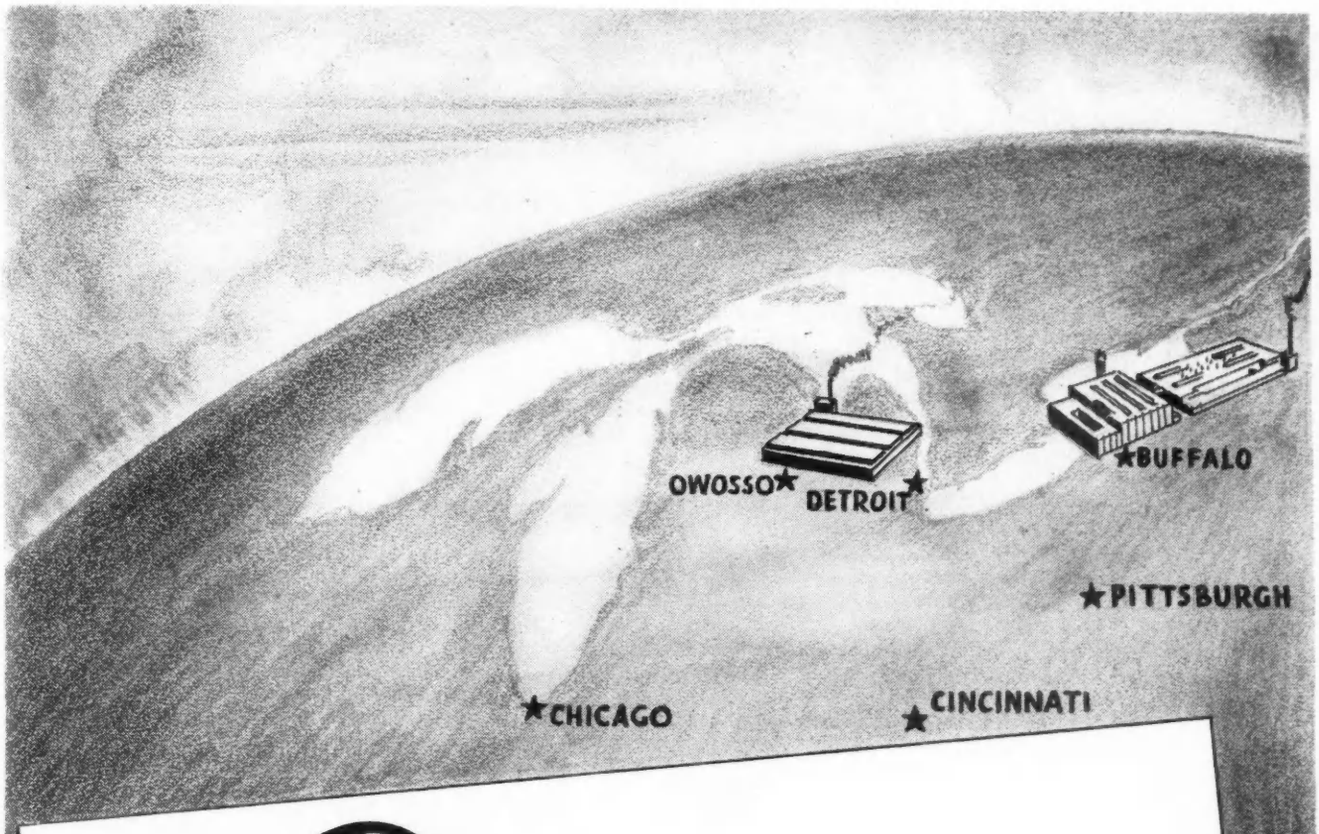
Pre-Cast Bearing BRONZE ON STEEL is a thin wall, laminated type of bearing. A high quality bronze alloy is permanently bonded to strip steel. The fabricating process, a series of stamping and forming operations, provides a low unit cost with accuracy and precision.

While *Pre-Cast Bearing* BRONZE ON STEEL was developed primarily for sleeve bearings, it has found many other important applications in industry. It is an ideal metal for stampings, washers or other flat pieces. Available either in rolls . . . up to 400 feet in length . . . or as finished parts, made to your specifications.

Investigate the possibilities of *Pre-Cast Bearing* BRONZE ON STEEL in your product. Complete information—FREE.

Write for this folder that fully describes this new and unusual bearing. It's FREE.

JOHNSON BRONZE
Sleeve BEARING HEADQUARTERS
625 S. MILL STREET · NEW CASTLE, PA.



fedders

2 BIG FACTORIES

BUFFALO, N. Y. . . . . OWOSSO, MICH.

AIR CONDITIONING DIVISION

Unit Heaters
Air Conditioning Units
Cooling Coils
Heating Coils
Comfort Coolers

REFRIGERATION DIVISION

Refrigerant Control Valves
Finned Coils
Bare-Tube Coils
Air-Cooled Condensers
Unit Coolers
Ice Cube Maker Evaporators
Water Coolers

AUTOMOTIVE DIVISION

Automotive Radiators
Automobile Heater Cores
Aircraft Engine and
Oil Cooling Equipment

FEDDERS MANUFACTURING CO., INC. General Offices - Buffalo, New York

Quality Controls of Wright Engine Parts

(*Continued from page 17*)

tain the serial number of each piece and are kept available for further reference. The information contained on these records is conveyed to the vendor on monthly reports, and has materially aided in their research to produce a better grade of steel. When first adopting the Magnaflux method of inspection, our steel rejections were exceptionally high, but through close cooperation with steel vendors, coupled with earnest efforts on the part of the Manufacturing Department to reduce the number of grinding checks, our rejections have been reduced to a minimum.

Our only expectation from this method of inspection is to reveal indications of a minor or serious nature, on which we may arrive at a decision, and reject those parts we believe unfit for safe use or operation, being guided by experience, performance of parts in service, and by no means least the decisions of our Laboratory and Engineering Department. The location of the defect on highly stressed parts predominates as a main factor in making a decision.

As a precaution against possible failure, inspectors are carefully instructed to check all parts thoroughly for burrs or sharp edges. All corners on parts produced at the Wright plants are radiused to eliminate the possibility from this source. Wherever possible, the use of steel stamps on steel parts has been eliminated and a rubber acid etching stamp substituted for the purpose of identification. On the few parts where it is absolutely necessary to use steel stamps, special stamps with radiused characters are employed.

To improve the standard of surface finishes, we have recently adopted the Profilometer surface finish measuring equipment by which finishes are measured in micro inches. Standards of finishes are now being prepared by our Engineering Department for various parts and such information will, upon completion, be incorporated on our blue prints.

A large portion of the Inspection Department has been assigned to the inspection of materials received from vendors. Close cooperation is maintained between vendors supplying parts and the Inspection Department, and we have greatly encouraged the practice of having vendors furnish samples of parts before proceeding with an entire order. In this way, any deviations from blue print specifications may be corrected by vendor prior to furnishing parts in large quantities, thus eliminating the possibility of rejections, or costly rework, in addition to menacing delays in production which may result.

Inspection Percentages

Practically all parts used in Wright Aircraft engines are given 100 per cent inspection. However, small parts, such as nuts, washers, cotterpins, etc., are given a 10 or 15 per cent inspection, and in the event any defects are noted, the entire lot is inspected 100 per cent. Component parts of assemblies are given a 100 per cent inspection in both the detail and assembled conditions. Foolproof gages and fixtures have been designed for various inspection operations, resulting in more efficient control of quality standards.

To illustrate the inspection detail involved, inspection operations numbering in excess of 55,000 are performed on each 14-cylinder engine reaching the final assembly line. Of this number 850 inspection operations are performed on a single crankshaft with its component parts.

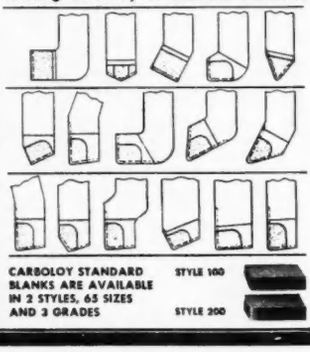
From Blueprint To "Tool-up" In Less Than 1 Hour!

Braze Your Own Carboloy Tools . . . Get Them On Emergency Jobs FAST!

Emergency periods call for quick action. When a job must get under way fast—when you need Carboloy tools "yesterday"—*why not braze your own Carboloy tools?* . . . It's a simple short cut that eliminates ordering time and avoids routine "hold ups" awaiting deliveries.

Many plants now keep a stock of Carboloy Standard Blanks in their tool crib . . . ready, on a moment's notice, to make up a tool and get it on the job *fast!* . . . less than an hour for most single-point, straight-shank tools!

A Few Typical Tools You Can Make ...Using Carboloy STANDARD BLANKS



CARBOLOY STANDARD BLANKS ARE AVAILABLE IN 2 STYLES, 65 SIZES AND 3 GRADES

STYLE 100

STYLE 200

Just three simple steps are necessary to do this in your tool room.

1. Preparing Recess in Shanks

To accommodate the Carboloy blank in your tool shank it is necessary to provide a recess in which the Carboloy Blank can be inserted. This is a simple operation that can be done on your regular tool room milling or grinding equipment.

2. Brazing Carboloy Blank to Shank

Brazing the Carboloy Blank to your shank requires less than 5 minutes on most straight-shank, single-point tools. To do this you simply need a torch, and a few inexpensive accessories: Silver solder, flux, carbon tetrachloride, etc.

3. Grinding the Brazed Tool

Simple—fast—as easy as regrinding dull carbide tools, using the now-established, rapid grinding technique, and your regular carbide grinding equipment.

With these three simple steps you're prepared to meet emergency requirements immediately. Why wait—when you can get tools on the job *FAST*—by this simple procedure? Write for instruction booklet GT-116.

CARBOLOY COMPANY, INC.
11151 E. 8 Mile St.
Detroit, Michigan

Chicago • Cleveland • Los Angeles • Newark • Pittsburgh • Philadelphia • Worcester, Mass.

Representative: F. Robbins, Portland, Ore.—Seattle, Wash.

CANADIAN DISTRIBUTOR: Canadian General Electric Co., Ltd., Toronto, Canada.

CARBOLOY
Reg. U. S. Pat. Off.

STANDARD STOCK BLANKS
2 STYLES • 65 SIZES • 3 GRADES

Final Inspection

Upon completion of parts in the shop, they are routed to various final inspection cribs, which in all cases are conveniently located in or near the department in which the part was produced. In these final inspection cribs are located several hundred highly trained crib inspectors, but who refrain from making their own decisions on parts which may vary in any way from blue print requirements. In those cases, the inspector contacts his immediate supervisor, who from his long experience and thorough knowledge of the functions of the part in question, may either decide whether the part is usable, or if it is advisable to forward it to the Salvage Department for further consideration. In the event a part is to be forwarded to the Salvage Department, it is accompanied by a hold ticket on which a complete and detailed description of the defect is recorded.

Salvage Department

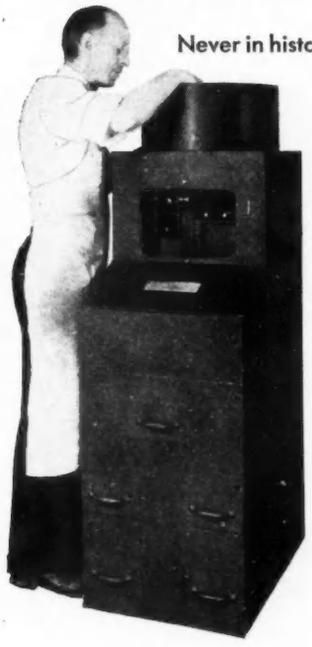
The Salvage Department makes a careful study of all parts submitted to it, and through its committee, consisting of representatives of the Army Air Corps, Engineering, Production and Inspection Departments, make decisions as to whether or not parts are usable, or whether same are to be corrected by rework.

In order to minimize the amount of scrap and rework, a special committee has been appointed, reporting directly to the Production Engineering Department, to work in close coordination with the Inspection Department. It is the duty of this committee to carefully study parts received in the Salvage Department, to determine the reason for any discrepancies reported. By close study and observance this committee is able to trace such errors to their source, which are at times caused by worn bushings, carelessness on the part of the operator, or the use of incorrect grinding wheels. The committee then conveys to the foreman in charge recommendations as to the corrective action to be taken to prevent a recurrence of the trouble encountered. This committee is also furnished with a daily list of rejections encountered and rework performed by various departments in the shop. From these records, the committee can readily detect where any excessive amount of rework or scrap is being experienced. Similar records are also supplied to shop foremen who use them as a reference in making corrective machine setups.

Finished Stores

After final inspection of parts, steel parts are carefully degreased to remove any dirt or stains caused by handling, then oiled and wrapped to guard against rust, after which all parts are routed to Finished Stores, accompanied by a transfer ticket on which is recorded the quantity, part number, part name, sales order for which same are

Locomotives have improved vastly since those ambitious little wood burners struggled across the Union Pacific in the early 70's. The streamliner of today can do far more and do it much faster.



Never in history has progress been made more rapidly in precision gaging than in the last few years. Both standards of accuracy and gaging speed have made spectacular advances. The human equation, such an unpredictable factor just a few years ago, becomes much less troublesome.

Sheffield has its part in this march of gaging progress. It was Sheffield which produced the automatic gage illustrated—also the Electrigage, the Multichek Electrigage, the Precisionaire, the Thread Lead Checking instrument and others. If you are not familiar with what these instruments have accomplished in increased accuracy and faster inspection, write us for the story.

THE SHEFFIELD CORPORATION
Gage Division · DAYTON, OHIO, U.S.A.

SHEFFIELD MASTER GAGEMAKERS

intended, and the inspector passing the material. From information contained on transfer ticket, clerks in stock room may keep a perpetual inventory of parts on hand, and also eliminate any possibility of mixup due to similarity of parts.

Assembly Inspection

After the parts are delivered to Finished Stores, they are placed in bins or racks and held until orders are received from Materials Control Department to build a group of engines. The parts are pulled from their location and placed on segregation racks, and then delivered to the minor assembly benches in the Assembly Department for assembly, also for fitting to get proper clearance as required by specifications. The sub or minor assemblies when completed are inspected by an inspector, and then passed on to the green or production line for engine build-up.

New Ideas in a Small Parts Hardening Furnace

(*Continued from page* 35)

through an electric timeclock. The pushing cycle may be varied from 3 to 7 minutes, depending upon the type of case desired on the parts. Where specifications call for file hard case the cycle usually is set at 3 minutes; where a heavier case, such as 0.010-inch, is required, the cycle is lengthened to 7 minutes. Thus the only variable is the pushing cycle, the temperature and carburizing gas mixture being held fairly constant.

Double doors also are provided at the discharge end. As two trays emerge into the discharge vestibule, a set of arms pulls them out onto an elevator which lowers them into the oil quench tank. The cycle of this elevator also is controlled by an electric timeclock, on the same basis as the pusher. In the oil the trays rest on an inclined chain conveyor which moves them up and out of the oil to permit an operator to unload. As parts are unloaded from the trays the latter are placed on an inclined roller conveyor which returns them to the charging end of the furnace for the next load. An unusual feature of the quench tank is that it is above floor level, easily accessible for maintenance and inspection.

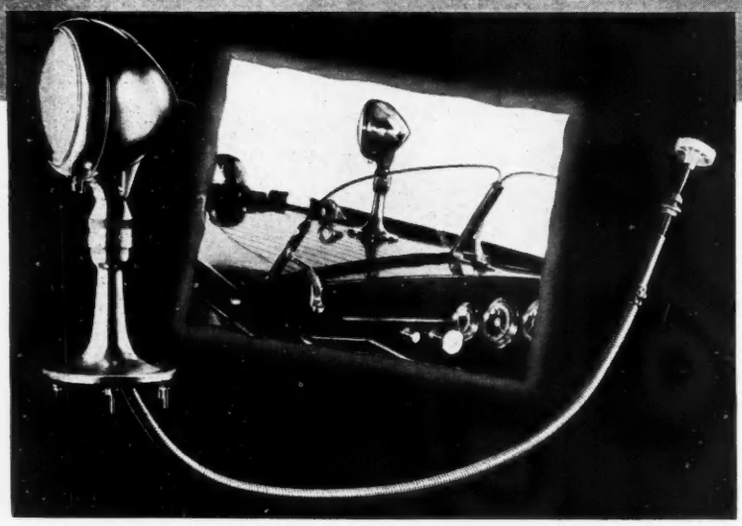
This is possible because the rails on which the trays ride inside the furnace are 43½ inches above floor level. Other dimensions of the furnace are: Overall height, 9 feet 1½ inches; inside width 4 feet 3 inches; inside length 27 feet 6 inches; available height inside 2 feet 2 inches; width to outside of buckstays is 7 feet 5½ inches; sidewall thickness 14 inches; distance between centers of top and bottom radiant tubes 4 feet 11 inches. The design of the furnace and generator was developed by Holcroft & Co., Detroit.

It is always possible to vary the operation of the furnace for special purposes. For example, propeller shaft couplings require no case, merely a clean hardening, so the ammonia is shut off when such parts are being processed and they are given a straight heating at 1525 and an oil quench.

Electrolytic Hexane

German investigations have shown that hexane, one of the principal constituents of gasoline, can be obtained by electrolysing butyric acid, which is produced by fermentation. However, electrolytic hexane has a low octane number, being of the straight-chain type of hydrocarbons. By subjecting butyric acid to thermal decomposition, di-n-propyl ketone is obtained, a compound having a freezing point of minus 29 deg. Fahr. and a boiling point of 289 deg. The octane number of this product ranges between 92 and 99. It will mix readily with either absolute or hydrated alcohol and in this form can be used as motor fuel.

2-Way Remote Control WITH A SINGLE S. S. WHITE FLEXIBLE SHAFT



The IVALITE marine spotlight is a product of Ivano, Inc., Chicago, Ill. The upper illustration shows it mounted on the bow of a Chris Craft with the control knob on the dash.

The spotlight illustrated provides an excellent example of **combined rotation and "push-pull" obtained with a** single flexible shaft. The light can be turned horizontally in a complete circle by rotation of the flexible shaft and tilted up and down by a push-pull movement. The flexible shaft also makes it possible to mount the light in any desired location and the control knob in the most convenient place.

Engineers will find in S. S. WHITE Remote Control Flexible Shafts a simple, dependable solution to similar problems of two-way remote control. These shafts, specially designed for remote control, provide smooth, easy operation even in long lengths. They are available in diameters from .130" to .437" and lengths up to 50 feet.

BULLETIN 38 gives full details about these shafts and their application. A copy will be mailed on request.

S. S. WHITE

The S. S. White Dental Mfg. Co.

INDUSTRIAL DIVISION

Department A, 10 East 40th St., New York, N. Y.